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Surgery, Gynecology and Obstetrics

WITH

International Abstract of Surgery

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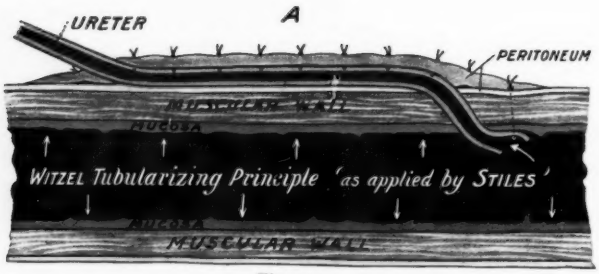

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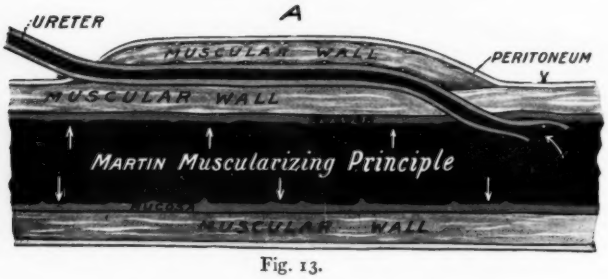

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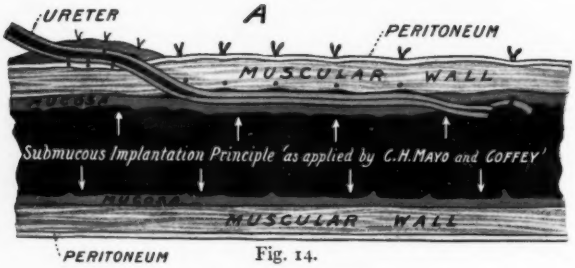

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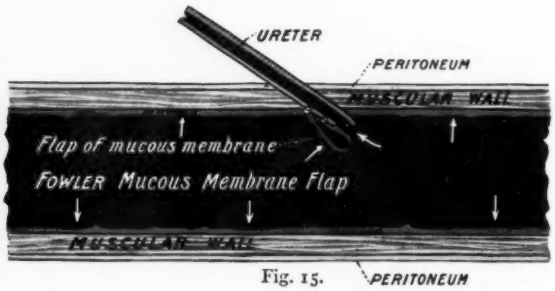

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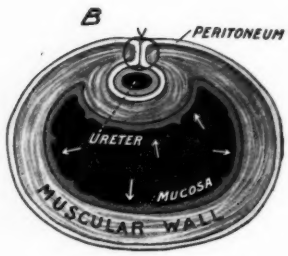

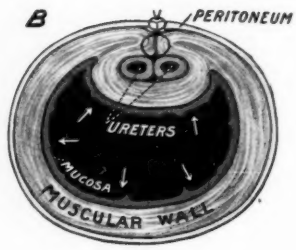

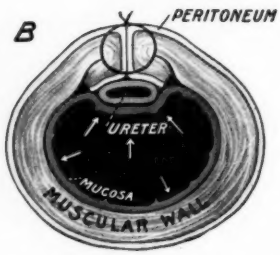

Fig. 13. The Martin muscularizing principle. *A*, The peritoneum has been dissected off the muscle and the muscle wall is made to form a virtual sphincter around the ureter. The peritoneum is then closed over all. It is evident that intra-intestinal pressure could not effectually close the mucosa if the muscular wall were completely intact. *B*, Cross section which shows the principle and how the muscle is drawn around the ureter.

Fig. 14. Submucous implantation principle. *A*, The ureter is seen to traverse the space between the mucous membrane and the muscle, the mucous membrane having been carefully freed from the muscle. *B*, Cross section shows the principle involved and how the thin, loose mucous membrane alone intervenes between the intra-intestinal pressure and the ureter.

Fig. 15. The principle of the Fowler mucous membrane flap, which is in no way similar to the three previously described principles.

Fig. 12. The Witzel tabularizing principle, as applied by Stiles. *A*, Note that the entire thickness of the intestinal wall, including muscle, mucosa, and peritoneum, is interposed between the ureter and lumen, making collapse of the ureter impossible. *B*, Cross section showing relation of the ureter to the wall, in the Stiles operation.

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TRANSPLANTATION OF THE URETERS INTO THE LARGE INTESTINE IN THE ABSENCE OF A FUNCTIONATING URINARY BLADDER[1]

BY ROBERT C. COFFEY, M.D., F.A.C.S., PORTLAND, OREGON

ELIAS HOWE invented the sewing machine and patented it. In a few years there were great numbers of sewing machines of other makes and under other names, equal to or better than the Howe machine. It has been said that there was but one mechanical principle that he was able to hold under his patent. That was: "An eye at or near the point of the needle." Without using this fundamental mechanical principle the sewing machine could not be made. Fundamental principles of this kind have been used by nature in the human organism when possible, but they have usually been supplemented, in vital positions, by a certain development of muscular fibers. For instance, a defect in the valves of the heart is compensated for by increased muscular development of the heart. A defect in the valves of the superficial veins of the leg produces varicose veins but is compensated for by muscular action which carries the blood along the deep veins toward the heart.

I have been credited in some textbooks and other publications with the technique of an operation for implantation of the ureter into the large intestine, which is gaining in popularity. I am very proud of this recognition, yet I have not been entirely satisfied with it as I contend the technique was developed only after the essential principles had been formulated. I will briefly relate the development of this operation.

In the home of Dr. W. J. Mayo, in the winter of 1908, I was listening to his analysis of surgical problems and surgeons. Finally, the question turned to my own work, which he discussed encouragingly in some instances and disparagingly in others. During this discussion he suggested that the pancreas was a very prolific field for investigation and urged me to see what could be done with it.

I accepted the suggestion, went home, constructed a new animal hospital, and started to work. I immediately recognized that the one essential thing necessary to do surgical operations on the pancreas was the ability to deal with the remaining pancreas after a portion had been removed. Removal of the head of the pancreas was a difficult problem. This, however, we did successfully by doing it in two operations. First, the stomach was cut off, a gastro-enterostomy performed, the bile-duct transplanted into the duodenum lower down by the direct method described by W. J. Mayo a few years before (Fig. 1). Two weeks or more afterward, the duodenum and head of the pancreas were removed. Then the pancreas was implanted into a specially prepared loop of small intestine (Fig. 2).

In the conduct of the experiments a more interesting problem than the original one presented itself. I noticed that in every instance where the common bile-duct had been implanted into the duodenum it had become very much dilated (Fig. 3). In one instance

[1] Read before the Clinical Congress of American College of Surgeons, October, 1920.

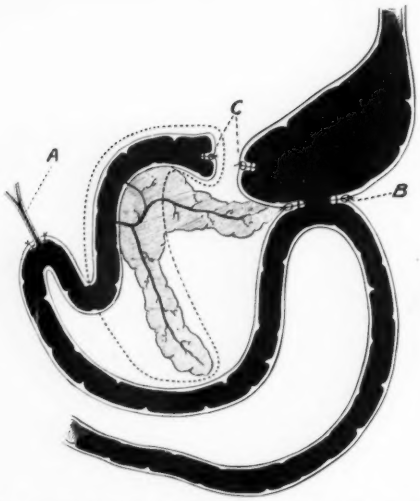

Fig. 1. First step in two-stage operation for removing the head of the pancreas, as was done in the first series of experiments. *a*. Bile-duct transplanted to intestine below the pancreas by direct implantation. *b*. Posterior gastrojejunostomy. *c*. Stomach cut in two and ends turned in. Dotted line encloses part to be removed at next operation. (*Annals of Surgery*, December, 1909.)

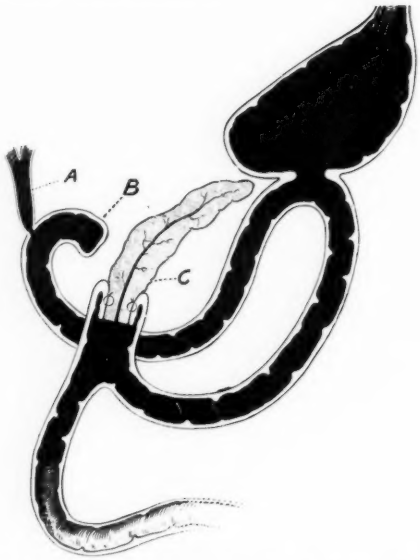

Fig. 2. Second step in two-stage operation for removing head of the pancreas. *a*. Widely distended bile-duct which was transplanted at previous operation. *b*. Remaining stump of duodenum after removal of duodenum and head of the pancreas. *c*. Remaining tail of the pancreas implanted into intestinal loop. (Diagrammatic.) (*Annals of Surgery*, December, 1909.)

it was found to be even as large as the duodenum. This dilatation had apparently continued until a compensatory thickening of the duct wall had stopped the process. This dilatation, including the opening into the intestine, therefore, was not due to obstruction. The following soliloquy or catechism took place in my mind. Why does the common duct, thus implanted, dilate and thicken in this way? Evidently because of some force exerted within the duct. What force is there present? Answer: The small intestine, as well as the large, is practically always found in a state of rotundity and partial distention. That distention is chiefly gas or liquid under pressure. That pressure may, for want of a better name, be called *intra-intestinal pressure*. In short, my conclusion was that the thin-walled duct implanted into the intestine directly was dilated by *static intra-intestinal pressure*. That was the chief proposition. The second proposition was, how has nature prevented this *intra-intestinal pressure* from reaching the inside of the normal duct?

Dissection of the duodenum showed that the common duct passed through the wall of the intestine down to the mucosa and ran for a distance under the loose mucosa before emptying into the bowel. This probably accounted for the normal undilated state of the common duct. The next question: "Is it purely a mechanical affair or due to muscular control?" A rubber bag, an ordinary irrigation bag, was taken. A hole was made in it and a rubber tube cemented into the hole. A thin flap of rubber was cemented on the inside of the rubber bag. A fountain syringe was attached to the rubber tube and the rubber bag was filled from the fountain syringe through the rubber tube. On detaching the fountain syringe from the filled rubber bag no water escaped. Pressure within the rubber bag collapsed the valve completely (Fig. 3). Therefore, whatever influence the muscle in the duodenum might have had, it was possible to protect the duct by purely mechanical principles.

Up to this point no technique has been tried and yet I contend that all the principles for

the successful implantation of a duct have been assembled. Namely, we have found that a duct always dilates when implanted directly into the intestine; that it thickens and establishes a point of compensation; that this dilatation is due to force; that this force is the gas and liquids confined in the intestine, and may be called *intra-intestinal pressure*. Nature has run a duct immediately under the loose mucosa permitting of closure by *intra-intestinal pressure*. And finally, an inanimate, mechanical appliance proves that the mechanical feature is sufficient of itself to prevent dilatation of the duct. All the engineering and all the architectural work has now been done. We are ready for the mechanical work. We, therefore, tell the mechanic that he is to implant this duct or tube into the intestine and that he must run the tube for some distance immediately under the mucous membrane before it emerges into the lumen of the bowel. In other words, the mechanic works out the technique. I have been credited with the mechanical part of the work but not with the architectural or engineering. As a matter of fact, the technique of placing the ureter immediately under the mucous membrane, as described, did not require much thought and is not a procedure that should add much to the reputation of any surgeon. I am sure any surgeon of average ability would have done the same after the principles had been assembled and formulated.

Having formulated these principles the next step was to implant the duct. As a matter of proof we implanted the common duct in a series of dogs by running the ducts immediately under the mucosa by the technique herein described. In not a single instance did the common bile-duct dilate when so implanted. Up to this time the question of implantation of the ureter had not been thought of by me. I had never read an article on the implantation of the ureter nor did I know anything of the methods that had been tried.

In going through the literature of the common bile-duct, during the preparation of the paper, I began to discover references to the literature of implantation of the ureter into the intestine, so that when the paper on the pancreas, including the implanting of the bile-duct was presented, at Hot Springs, Virginia, in 1909, I made the suggestion that the same principles would probably apply to the implantation of the ureter. And when I came home, started another series of experiments to test out the feasibility of the application of these principles to ureteral implantation.

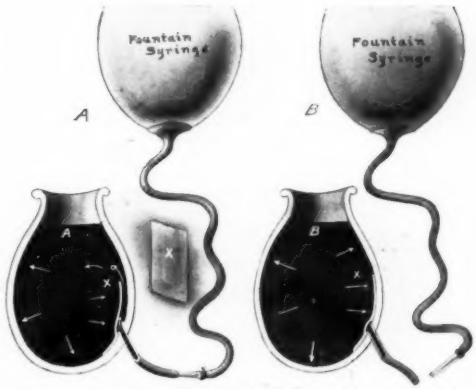

Fig. 3. Partial artificial lining of a rubber bag with a thin piece of rubber cemented on the inside. *a*. The fluid is running into the bag notwithstanding the pressure indicated by the arrow because the height of the fountain syringe produces greater pressure than exists in the bag. *b*. When the greater pressure from the fountain syringe is removed, the intravesical pressure collapses the inside lining.

In six dogs the same method of direct implantation of the ureter was applied as was used in the direct implantation of the bile-duct. All of the dogs died except one. In the one which lived the ureter was somewhat dilated and very much thickened, and the kidney had been destroyed, leaving a fibrous knot. The opening into the bowel was large and the ureter was a diverticulum on the large intestine, ending with the pelvis of the fibrous knot which represented the destroyed kidney (Fig. 4, *b*). Of nine dogs in which the ureter was implanted by the submucous method, six recovered, from five of which specimens were taken to the meeting of the American Medical Association, at St. Louis, in 1910, and presented to the surgical section, of which Charles H. Mayo was chairman at that time. Those who were present may remember that in none of those specimens was the ureter dilated or the kidney injured.

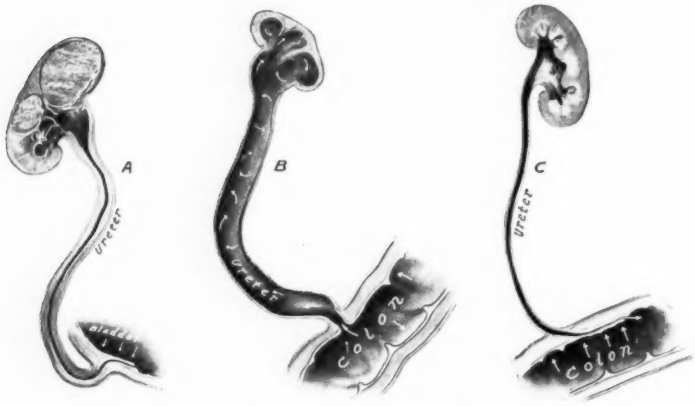

Fig. 4. The *modus operandi* of so-called "ascending infection." *a*. What probably happens in experiments where infection is injected around the ureter near the bladder; a true ascending infection following the lymphatics. *b*. Dead kidney; dilated ureter following direct implantation of the ureter into the colon. This result has been usually referred to as "ascending infection." It is more probable that the kidney has been destroyed and the ureter dilated by static intra-intestinal pressure applied inside the ureter. *c*. Normal kidney and undilated ureter which follow the submucous or indirect implantation of the ureter into the colon. (See Figs. 5, *a* and *b*.)

In fact, the closure of the duct against internal pressure by applying the static intra-intestinal pressure to the side of the duct was a success proved by the specimens (Figs. 4; 5, *a* and *b*; and Fig. 6).

In the preparation of this paper, before proceeding, I employed Dr. C. A. Fender, bibliographer in the Surgeon General's library, to go over the literature on ureteral implantation and abstract all articles pertaining to the phase of the subject I had under consideration. His abstracts failed to reveal any article which had set forth an operation based on the fundamental principles above given. Connell, Peterson, and Steinke had all reviewed the literature and had all reached the conclusion that ureteral implantation, experimentally on dogs at least, had a common ending, namely, destruction of the kidney, sooner or later. Therefore, this was the first series of consecutive successful implantations of the ureter into the large intestine of dogs that had been reported.

I came up to the St. Louis meeting with the following evidence that our principles above set forth, were true:

1. The bile-duct when implanted directly into a dog's small intestine always dilates.

2. A bile-duct which has been transplanted and made to run immediately under the mucosa of a dog's intestine for a distance does not dilate.

3. A ureter implanted directly into a dog's intestine always dilates and sooner or later the kidney is destroyed by pressure and infection.

4. A ureter which has been transplanted and made to run immediately under the mucosa of the intestine of a dog does not dilate, as a rule.

From this point the subject was largely developed by Charles H. Mayo into a clinical procedure which I believe must eventually be universally recognized.

The original technique which was first used on the common duct and later on the ureter by me is as follows:

First, the duct is located and ligated with linen or silk. It is then cut in two above the ligature and the edges caught and held with mosquito forceps, while one wall of the duct is split down with a pair of scissors. A linen suture is passed through the split end of the duct so as to include about one-half of it, and tied. The linen thread is thrown around the other half and tied. The loose ends are

threaded into two needles (Fig. 7). By this method the full strength of the duct is retained for traction, while the opening is maintained by the split. The end of the duct is wrapped with gauze while the intestine is prepared for its reception, which is done as follows:

The part of the intestine desired is picked up and an incision made down through the peritoneal and muscular coats, including submucous tissue. The muscular layer is loosened from the mucosa with the point of the knife until the mucous membrane pouts out through the incision. This incision should be about one inch long or more (Fig. 8). Then, five or six sutures are passed which pick up the peritoneal and muscular coats on each side of the incision. The suture at the upper end of the incision is tied as a control suture. The intermediate intestinal sutures are lifted up on the flat handle of an instrument as they cross the incision. Now the intestine is brought down close to the end of the split duct and the two needles carrying the threads (traction sutures) on the end of the duct are passed beneath the four or five intestinal sutures and through the stab wound in the mucous membrane into the intestinal lumen and out through the intestinal wall three-quarters of an inch farther along the intestine, and one-eighth to one-quarter inch apart. By making the tension on these threads and at the same time pushing the intestine toward the duct, the duct is drawn beneath the intestinal sutures through the stab wound into the intestinal lumen (Fig. 9). The two ends of the threads on the duct are tied on the outside, thus anchoring the ends of the duct on the inside of the intestine at this point. The intestinal sutures are then tied. After this operation the duct lies just beneath the mucous membrane, which has been loosened for approximately three-quarters of an inch of its course, so that it slides easily in its new channel. It is therefore necessary to tack the ureter to the peritoneum of the intestine near its point of entrance by two or three fine linen or silk blood-vessel sutures (Fig. 10). Care should be used to take only the outer coat of the ureter in the bite of these sutures. Thus, practically all of the steps of the operation are completed before the intestinal mucosa is penetrated and no sutures penetrate the lumen of the ureter. The traction suture at the end of the ureter within the intestine and the two or three anchor sutures fastening the duct to the intestinal peritoneum are the only means of retaining the duct in place. (For additional security another line of continuous chromic catgut suture may be made to cover in this first line as recommended by Charles H. Mayo.)

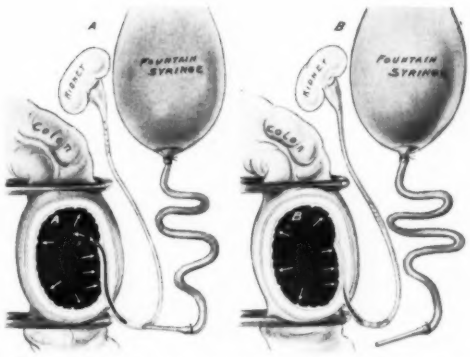

Fig. 5. Segment of intestine into which the ureter was implanted 169 days prior to removal of specimen. *a*, Running fluid into segment of intestine under pressure. (A counterpart of experiment made on rubber bag, Fig. 3.) *b*. Shows pressure of fountain syringe released by withdrawal of nozzle. The pressure within the intestine immediately closes the valve by pressure on the mucous membrane. Not a drop could be forced back into the duct. (An exact drawing of the valve in the same specimen is shown in Figure 6, *b*, compared with the valve in a normal dog's bladder, Fig. 6, *a*.)

The modifications in technique and clinical application which have been done by Dr. Mayo may be grouped and expressed in the one word, "clinicalization," and are as follows:

He has used fine catgut instead of linen. He has left off the control suture at the upper end of the implantation wound. He has used curved rubber covered clamps for holding the intestine. He has supplemented the interrupted sutures with a continuous catgut (Fig. 11). He has called attention to the necessity of implanting the right ureter first low down in the rectum, and at the same time fastening the parietal peritoneum to the intestine near the anastomosis. Ten days or two weeks later he transplants the left ureter

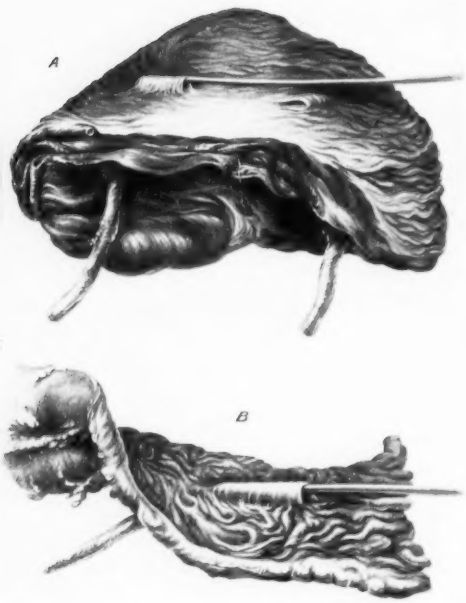

Fig. 6. *a*. The valve in a normal dog's bladder is lifted on the end of a probe. *b*. The valve in a dog's intestine following submucous implantation. Specimen removed 169 days after implantation. Compare with valve in dog's bladder.

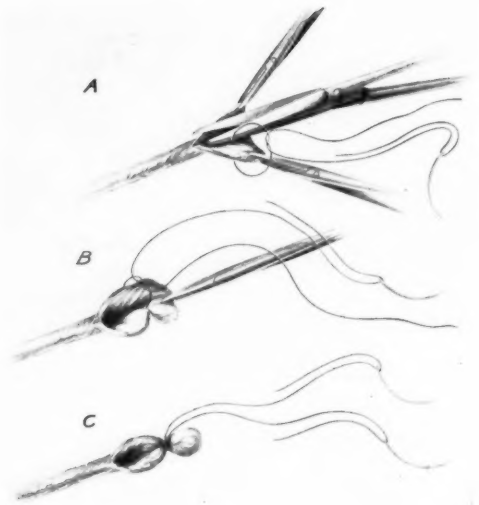

Fig. 7. Preparing the duct for implantation. *a*. Duct has been cut; the end is being split; a linen or silk thread is passed through half of the duct and tied. *b*. The other half of the duct is being tied. *c*. Both ends of sutures threaded into needles.

to the sigmoid and states that Dr. Judd has further modified the technique on the left side by reaching the ureter outside the peritoneum and doing the anastomosis between the ureter and sigmoid extraperitoneally.

In the after-treatment Dr. Mayo recommends the use of a perforated rubber tube in the rectum for some days afterward, particularly after the second operation. He states that the most favorable age for operation is from 4 to 10 years. In Osler's *Memorial Volumes* Dr. Mayo makes the following report of his work on exstrophy of the bladder:

"In our series of 52 patients, 6 were operated on by the plastic method; 1 died 6 months later (traumatic exstrophy at childbirth); 3 patients were operated on by the Maydl-Moynihan method, 2 of whom died of uræmia. Twenty-six were operated on by the transplantation method, 22 successfully; 2 of these patients had but one kidney each. Four died shortly after operation. Seventeen of the 52 patients were not operated on at the time of their examination; some of them were too young and are to be operated on later; others with diseased or dilated ureters were advised against the operation."

In addition to this large clinical experience of Dr. Mayo I may briefly report my own clinical experience as follows:

CASE 1. My first patient was operated on October 17, 1913, for extensive, and I may say, almost inoperable cancer of the uterus, in which the base of the bladder and about 4 inches of the left ureter were involved in the mass. The uterus and left ureter, and a portion of the bladder were removed and the bladder wound closed. The carcinoma also involved the sigmoid flexure by contact, and the sigmoid flexure was therefore removed. The proximal end of the sigmoid was brought out through the left rectus muscle, making a permanent colostomy. The distal end of the sigmoid and rectum were closed and the left ureter implanted into the isolated rectum. The left kidney began to secrete urine immediately in a somewhat larger quantity than the right ureter was delivering into the bladder. The patient lived for about 8 months, finally dying of recurrence of the cancer in the liver and upper abdomen. I was informed by the family that the rectum continued to discharge clear urine up to the time of the patient's death, so that while the patient died 8

Fig. 8. Incising peritoneal and muscular coats of intestine and freeing mucous membrane from the muscular coat.

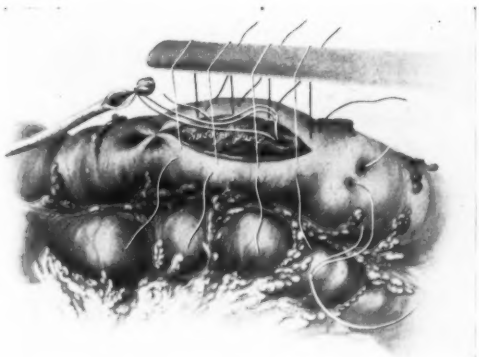

Fig. 9. Sutures have been passed and duct is being drawn down under the intestinal sutures through the stab wound in the mucous membrane.

months later, the result of the implantation was perfect.

CASE 2. On January 3, 1914, I implanted a ureter for exstrophy of the bladder in a male child. 2 years of age. There was a good deal of fever on reaction and the child was quite sick for 2 or 3 days, which phenomenon, by the way, Dr. Mayo had told me privately, has occurred in most of his cases, the exact cause of which we do not know. On June 17, 1914, I implanted the other ureter. This has been now 6 years since the operation. I am informed that the patient is in perfect health; is able to go to school as other normal children; the bladder has never been removed as the father is well satisfied with the condition as it is at present.

CASE 3. This was one of far advanced cancer of the bladder in a man. Most of the bladder wall was involved. The patient was very uræmic. On November 11, 1912, I implanted the right ureter into the pelvic colon. It was quite dilated and was probably thicker than it should have been for this purpose. The implantation was a success and the ureter immediately began to discharge its urine into the rectum. December 8, 1915, the left side was opened with a view of implanting the left ureter, also, when it was found that the ureter was dilated, thickened, and after it was cut it was shown there was no urine being excreted. In other words the kidney was dead from back pressure. It never came to life again. At this time the bladder was removed; the patient went home and died several months later from recurrence of the carcinoma in the abdomen. In this case the lone right kidney apparently was never involved.

CASE 4. This was a young female child, 6 years of age, who came to me December 7, 1917, with exstrophy of the bladder. The right ureter was implanted at this time. February 28, 1918, the child returned and the second ureter was implanted. There was a great deal of disturbance at this second operation. The patient made a good recovery and I am informed has been perfectly well ever since. The bladder in this case has not been removed, as the mother is so well satisfied with the child's condition she dislikes to have anything further done.

CASE 5. January 28, 1918, a man came for contraction of the bladder, which had been ulcerated for many years, and which held less than an ounce of water under anæsthesia. The patient suffered tremendously and was decidedly uræmic. February 2, 1918, the abdomen was opened with a view of implanting the left ureter, and was found to be dilated to a size larger than a man's middle finger. It was, therefore, brought out through the left rectus muscle, hoping that the other ureter would be in better condition and that we might be able to implant the other and use the left kidney to functionate in the meantime. February 19, 1918, we opened the right side and found this ureter dilated larger than a man's little finger; very thick, unfitted, according to Dr. Mayo's experience as well as my own, for implantation into the bowel. The rectum was held over to the left side by adhesions to such an extent that we could not mobilize it and use it, thus proving the soundness of Dr. Mayo's contention that the right ureter must be implanted first. Therefore, the ureter was implanted into the cæcum. The patient was quite sick for a number of days; was decidedly uræmic; recovered entirely; went home; had loose bowel movements for several months. July 19, 1918, he came back with a view of having the left ureter implanted into the descending colon, as he was perfectly well and desired to get rid of the discharge of urine through the fistula. He stated at this time, however, that he had had loose bowel movements up to about 2 weeks before. This had gradually subsided. We then flushed out the bowel for a day or two and put a tube into the rectum to see whether the kidney had ceased to functionate. No urine apparently came down

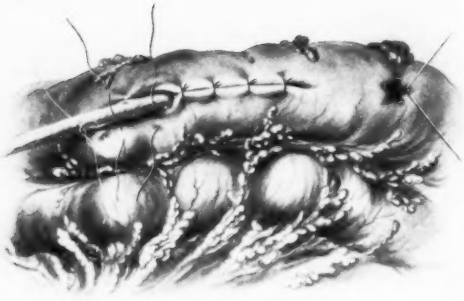

Fig. 10. The duct has been implanted and anchored at its end inside the intestine by a traction suture; part of the intestinal sutures have been tied; the small anchor sutures are fastening the ureter to the peritoneum of the intestine; two of the intestinal sutures remain to be tied over the small anchor suture; the traction suture is being covered in by a Lembert purse-string suture.

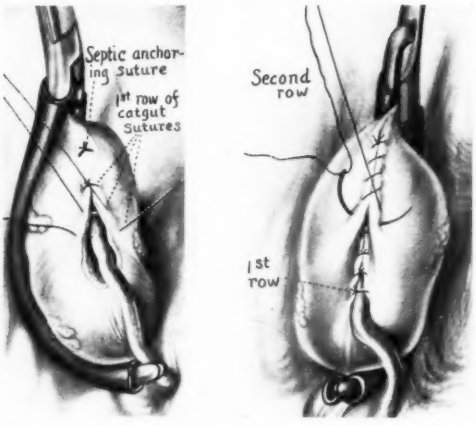

Fig. 11. C. H. Mayo's modification of the original submucous implantation described in Figures 7 to 10. Mayo has modified the technique as follows: (1) Use of curved rubber-covered clamps to hold the intestine. (2) The control suture at the upper end of incision shown in Figure 9 is omitted. (3) Fine chromic catgut is used instead of fine blood-vessel linen or silk. (4) Every other interrupted catgut suture picks up the ureteral wall. (5) A continuous catgut suture covers in all interrupted sutures. Osler *Memorial Volumes*, vol. ii.

through the rectum. Therefore, we concluded that the kidney might possibly be dead although the man was in perfect health. We decided to let well enough alone and left the other ureter discharging through the left rectus muscle high up, inasmuch as the patient was otherwise in perfect health and was required to wear only one cup to catch the urine.

I may state, the bladder has never given him a particle of distress since the urine was diverted.

Thus we have had four cases in which six ureters were implanted, and in which function afterward seemed to be perfect. We have had a fifth patient with implantation of the seventh ureter into the cæcum, in which the function of the kidney is not known. It may be secreting normally and the urine is reabsorbed, or it may be that the kidney has been killed by intra-intestinal pressure. At any rate, the man is in perfect health and never has had a symptom in the neighborhood of the right kidney.

At medical meetings and in reading the literature I have often been amused and at the same time somewhat exasperated at the careless way in which surgeons have apparently studied this subject. For instance, it is nothing uncommon for someone to stand in a meeting and state that this application of these principles is nothing new, that it has been done for 25 years or more. Others will describe it as a modification of the Martin operation, another of the Stiles operation, and another of the Fowler operation.

A careful study of these operations as described by the originators themselves, shows very clearly that the principles which we have set forth have in no way entered into the actions of these operators.

The Stiles operation is merely the rolling in of the entire thickness of the intestinal wall around the ureter. No mention is made of *static intra-intestinal pressure* as the means by which the outlet of the ureter is controlled. Furthermore, it is self-evident that even if the writer has had such an object in view, it would have been defeated by the thickness of the bowel.

The Fowler operation depends upon a loose flap of mucous membrane, which, according to the author himself, was intended to be pushed down by the fæcal mass in its descent, and made to cover the end of the ureter and in no way involved in the *static intra-intestinal pressure* produced by constant pressure of gas, which of course, would be as strong below the valve as above it.

The Martin operation is harder to differentiate from the submucous operation in that he cuts through the peritoneum down to the muscle and brings the muscle around the ureter, to be used as a sphincter to control the lower end of the ureter. However, he also combines, in his statement of principles, the Fowler principle which had been described the year before, and states that the fæcal mass, in passing down, would by its pressure on the mucous membrane, squeeze shut the end of the ureter and thus prevent fæcal matter from ascending it. In no place does he mention the influence of *static intra-intestinal pressure*, which is constantly present except in the wake of a peristaltic wave. Furthermore, the very fact of the muscle being between the ureter and the mucous membrane would, theoretically at least, prevent the collapse of the ureter by *static intra-intestinal pressure*. Furthermore, while about 45 per cent of reported direct ureteral implantations in the human have survived the operation and some of them have lived for a number of years, there is no absolute clinical evidence that the Martin operation, the Fowler operation, or the Stiles operation would give materially better results than the other direct implantations. We, in contra-distinction, submit Dr. Mayo's record along with my own and also that of Dr. Lower, of Cleveland, Dr. Hunner of Baltimore, and others, and contend that our results for submucous implantation of the ureter are sufficient to make it a justifiable operation and one which, after the technique has been tried out and perfected by experience of years, will probably make the question of bladder surgery much more settled and much more successful.

SUMMARY

Transplantation of the ureter into the large intestine is the most essential procedure in operations requiring removal of the urinary bladder.

The principal force to be dealt with in implantation of a duct into the intestine is *static intra-intestinal pressure*. The influence of *static intra-intestinal pressure* in dilating an unprotected duct mouth was first mentioned and described before the Southern Surgical Association meeting, at Hot Springs, Virginia, in 1909, and before the American Medical Association meeting, at St. Louis, in 1910. Submucous implantation of the duct, for the purpose of reversing the force of *static intra-intestinal pressure* and bringing it to bear on the side of the duct, was demonstrated in the same presentation, including the technique of the operation.

The essential mechanical principle necessary to the uniformly successful implantation of the ureter is that *the ureter shall be made to run immediately under the loose mucous membrane for a distance, before entering the lumen of the intestine.*

HIGH TRACHEOTOMY AND OTHER ERRORS THE CHIEF CAUSES OF CHRONIC LARYNGEAL STENOSIS

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IS high tracheotomy a justifiable operation? Before giving an opinion as to what the answer should be, it would be well to present gleanings from over 30 years' experience in the treatment of chronic laryngeal stenosis. During all these years the author has never been without cases of this kind to which he has fallen heir because the tracheotomists could not decannulate their patients, owing to an insufficient airway remaining in the larynx after the acute laryngeal stenosis had subsided; in other words, an acute laryngeal stenosis requiring tracheotomy had been followed, after tracheotomy, by a chronic laryngeal stenosis which prevented removal of the cannula after the acute condition, such as laryngeal œdema from diphtheria or some other inflammatory condition, had subsided. In a small proportion, approximately one-sixth of the cases, there had been necrosis of the cartilaginous framework of the larynx, probably due to the primary condition for which the tracheotomy was done. In the rest of the cases, approximately five-sixths, the chronic stenosis had been due to faulty tracheotomy or to improper after-care. This is in marked contrast to the results in our own cases. In a series of over one hundred cases of acute laryngeal œdema, tracheotomized by someone of us, not one case of chronic laryngeal stenosis resulted. The inference is plain that some radical difference in method exists, and investigation of the textbooks shows that tracheotomy is wrongly taught. The author believes that the patients coming to the bronchoscopic clinic for the relief of chronic laryngeal stenosis demonstrate that tracheotomy is the worst done of all operations and is perhaps the only one that has not been raised to its proper modern plane. This does not mean that all cases of chronic laryngeal stenosis are due to the tracheotomy; but the material shows plainly that high tracheotomy should never be done, and that the proper technique of after-care is generally unknown.

The tracheotomic causes of laryngeal stenosis may be classified under eight heads:

1. Hasty operation;
2. Attempts at general anæsthesia;
3. High tracheotomy even when classically done;
4. Division of the cricoid cartilage;
5. Sewing up of the wound;
6. Improper postoperative care;
7. Wearing of a cannula of improper size, shape, or material, or one with a fenestra;
8. Neglect of ordinary, decent cleanliness in the wearing of the cannula.

Going deeper, the chief underlying cause is in the faulty teaching of the textbooks. It is time that all sections on tracheotomy were rewritten. In passing it may be stated that all the foregoing causes of stenosis were undoubtedly (judging from another set of statistics) the causes of a heavy toll of mortality in other cases that did not have chronic laryngeal stenosis, because they died.

Hasty operation. This is usually the result of one or both of two things:

a. Postponing the operation too long. We all preach doing it early; but almost always do it late.

b. Attempting to give a general anæsthetic which precipitates arrest of respiration.

Hasty operation results in doing a high operation because the upper part of the trachea is more superficial; and all operators have in the recesses of their memories the faulty textbook teaching about the ease of high operations as compared to low operations; worse still they have recollections of instructions as to stabbing of the cricothyroid membrane, either with a knife or a special trocar-cannula of some kind. Had they been properly taught the equally rapid two-step, finger-guided operation, the patient's life could have been saved and he

would have run no risk of a chronic laryngeal stenosis. Hasty tracheotomy often leads to hacking the trachea. This results in islands of cartilage that in the necessarily infected wound are apt to become necrotic. If the ring-like support of the cartilages is lacking, the subsequent cicatricial contractions are unresisted, and this lack of resistance contributes one of the most difficult problems with which we have to deal in the cure of cicatricial laryngotracheal stenosis. In many of the cases coming to the bronchoscopic clinic for relief of chronic laryngeal stenosis, the tracheotomy had been done after the patient ceased to breathe and, hence, was a brilliant and life-saving procedure deserving of the highest praise; and the author would never sanction detracting in any way from the commendation justly due the particular operator. Yet having done many such emergency tracheotomies himself, the author feels justified in repeating what he has stated before, namely: that so far as rapidity of performance is concerned, nothing is gained by attempts at a stabbing operation through the cricothyroid membrane, nor, indeed, by any form of high operation. Were his experience limited to his own tracheotomies or even to those of his various assistants, he would not for a moment think of making such an assertion; but he has the testimony of hundreds of students whom he has taught his two-step, finger-guided operation. When the emergency came to many of these students, they saved the lives of their patients by an equally quick operation that, being low in the trachea, did not leave the chronic stenosis that so often follows the high operation. The technique of the two-step, finger-guided operation has been previously described a number of times,[1] hence does not need repetition here; but in passing it may be said that it rests fundamentally on making two incisions, the first of which splits open the entire front of the neck from "Adams apple" to the supra-sternal notch; the second incision opening the trachea which has been found by palpation with the left index in the pool of blood that fills the wound. The whole front of the neck being open the trained finger soon recognizes the corrugated or "washboard" feel of the trachea, and the knife is slid along the left index, the trachea being incised by sense of touch instead of sight. The safety of the slicing open of the front of the neck at the first incision depends upon keeping the patient's nose pointing to the zenith and upon memorizing the "tracheotomic triangle,"[2] which enables the operator to push back the danger lines and throw forward into prominence the safety line, in which there is absolutely no danger whatever of cutting any vessel of dangerous size. Such vessels as still bleed can be quickly caught up as soon as breathing has been re-established. So far as aspiration of blood is concerned this is minimized by the low head position; and the patient having no anæsthetic quickly coughs the air passages clear. The two-step, finger-guided operation does not require more than 1 minute and has often been done in less than 30 seconds.

General anæsthesia an error. General anæsthesia, or rather an attempt at it, contributes largely to the badly done tracheotomies that result in chronic laryngeal stenosis. Surgical literature abounds in reports of cases in which the attempt to give a general anæsthetic was followed by arrest of respiration, and a stabbing or other hasty operation saved the patient's life or, alas, only too often failed to save it. The reason for this large and needless mortality is to be found in the erroneous teaching of the textbooks. Of the 30 surgical textbooks examined, all mentioned general anæsthesia; none condemned it. Ten works advised chloroform, which is a highly efficient respiratory paralyzer; two advised morphine, which is likewise a respiratory paralyzer. It should be taught in all the textbooks on surgery and in all the colleges that *to give a general anæsthetic to a patient with obstructive dyspnœa is needlessly to endanger the patient's life.* A dyspnœic patient is depending on the aid of his accessory respiratory muscles. When he begins to pass under the influence of the general anæsthetic he loses the accessory aid

[1] Peroral Endoscopy and Laryngeal Surgery, 1914; Binnie's Surgery, 1917; Proc. Philadelphia Laryngol. Soc., 1913; also various journal articles.

[2] Loc. cit.

Fig. 1. Case No. L. S. 101. Boy, aged 3. The upper scar shows the site of the tracheotomy through the larynx that resulted in laryngeal stenosis. Below the scar is seen the cannular fistula in its proper place, in the suprasternal notch. This second tracheotomy was done as the first step in the cure of the laryngeal stenosis.

and the respiration ceases. So far as pain is concerned, in a patient not narcotic from carbonic acid, infiltration anæsthesia of the skin is all that is necessary. Tracheotomy even when no emergency exists, and all hæmostasis is completed as good surgery requires, should not take more than 5 minutes. Any pain inflicted after the incision of the skin is not greater than that inflicted for a much longer time on every human being in getting a tooth filled and for which no dentist would think of giving general anæsthesia. Five minutes of this degree of pain can be easily tolerated, and is no excuse for taking the enormous risks of mortality on the one hand, or of chronic laryngeal stenosis on the other. In passing, another fact, one that should alone utterly condemn general anæsthesia for tracheotomy, is that it paralyzes during the operation and for a considerable time thereafter, the cough reflex which the author has called "the watch-dog of the lungs." The cough reflex not only prevents the entrance of the potentially dangerous infectious materials and their pabulum; but, as a watch-dog might rid the house of rats that have already entered and multiplied, the cough reflex expels any incipient foci of multiplying organisms. The author is not unaware of the fact that postoperative pneumonias may be of hæmotogenous origin, nor that lobar pneumonia may be a septicæmia with a local manifestation; nevertheless there is such a thing as aspiration pneumonia and every surgeon will agree that infective agents and their pabulum should not be aspirated. Moreover, no one can deny that the cough reflex brings up infective agents and their pabulum. In the face of these facts it is hard to understand why any surgeon should use, or any textbook should sanction, general anæsthesia for tracheotomy. Add to this the undoubted fact that death or hasty tracheotomy, or both, are almost certain to follow the attempt at anæsthesia of a patient with obstructive dyspnœa, it seems that general anæsthesia for this operation should be universally condemned. Injection of the trachea with a cocaine solution is, in the author's opinion, objectionable for one of the reasons given against general anæsthesia, namely, abolition of the cough reflex. An active cough reflex is a great annoyance to the surgeon for a few minutes; but he will, of course, be glad to put up with the annoyance when he recollects that every portion of blood, pus, and secretion that is coughed in his face is just so much less of these potentially dangerous materials that could get in, or remain in the lungs.

High tracheotomy the chief cause of chronic laryngeal stenosis. Of the over two hundred cases of chronic laryngeal stenosis that have come to the bronchoscopic clinic for relief, and that form the basis of the present article, thirty had necrosis of the laryngeal cartilages. These 30 are eliminated from present consideration because the necrosis had probably resulted from the primary diseases, diphtheria, lues, typhoid fever, pneumonia, etc.; hence, they might have had chronic laryngeal stenosis from loss of the lumen-maintaining cartilaginous laryngeal framework. This framework, as we teach the students, is like the buckram in the lapel of the coat; it maintains the shape of the larynx and the laryngeal lumen. Its absence leaves the larynx especially liable to collapse. In this class of cases, however, the tracheotomy is not often at fault. The condition, it is only fair to assume, has resulted from the

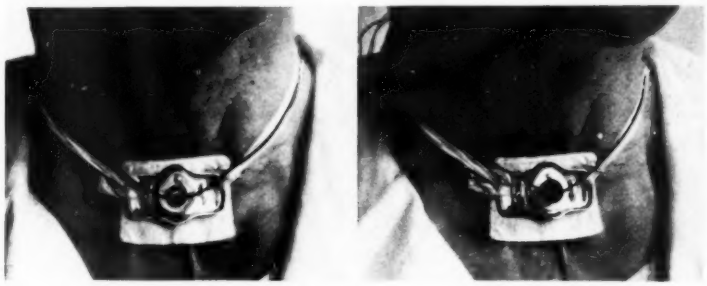

Fig. 2 (at left). Case No. L. S. 102. Tracheotomic cannula in proper position. Above it is seen the scar of the first tracheotomy, which caused the laryngeal stenosis. The cannula is corked with a pure rubber cork in one side of which a groove has been ground to admit some air, the stenosis of the larynx not being yet completely cured. A braided silk ligature is attached to the cork to prevent its being lost when not in the cannula.

Fig. 3. Same case as in Figure 2. Cannula tightly corked, respiration being carried on through the mouth. The cannula being of proper size and properly fitted, there is an abundance of room for the by-passage of air past the cannula in the trachea.

primary condition that required the tracheotomy: perichondritis from trauma, diphtheria, lues, etc., the latter two diseases, especially, being often necrotic processes. Many cases have come in with loss of cartilage due to war wounds. All the cases from the service are of this character, in which stenosis was due to the primary condition, not to the tracheotomy. Of the remaining 170 cases, 158 (93 per cent) had been "high" tracheotomies; 32 of the 158 having been done through the cricothyroid membrane and thyroid cartilage, really through the walls of the larynx itself: laryngotomies, not tracheotomies at all. The chief reasons why high tracheotomies result in stenosis, we believe to be these:

a. The larynx, including the subglottic region, is narrower than any other portion of the laryngotracheal airway.

b. The subglottic tissues, in children especially, are intolerant of contact. Wearing of a cannula in this location causes prolonged inflammation and subsequent cicatricial contraction ending in stricture.

c. High tracheotomy usually means, in practice, division of the cricoid cartilage, though in theory it means only that the operation is to be done above the isthmus of the thyroid gland. As elsewhere mentioned, division of the cricoid cartilage means loss of the only complete ring-like support to prop open the lumen of the laryngeal airway. But division of the first ring is also better avoided, because the inflammatory reaction that results from the mixed infections inseparable from a wound accessible to the air leads to stenotic infiltration of the superjacent subglottic tissues, which are not only at the site of a narrower lumen than that of the lower trachea, but the subglottic tissues are of a different character from those of the trachea proper. Prolonged wearing of the cannula will result in a larger, more intractable spur on the posterior wall above the tracheal cannula, in the high than the low region. To come down to the matter of statistics, in the entire 34 years of the author's experience with laryngeal stenosis, there never has been, to the best of his recollection, a single patient sent in with a chronic laryngeal stenosis due to a low tracheotomy. In all of the cases in which a low tracheotomy had been done the stenosis could be justly attributed to the primary condition that had rendered the tracheotomy necessary. As a matter of fact relatively few low tracheotomies have come at all, a fact that bears two interpretations: (a) Most tracheotomies are postponed until emergency requires a hasty operation, which to most men calls particularly for a high operation; (b) the advisability of low tracheotomy (below the second ring)

has never been taught with sufficient emphasis One of the worst features about the classical teaching of a high and a low tracheotomy is that it leads the operator, especially if he is not a trained surgeon, to think of a high and a low skin incision; whereas in any tracheotomy, high, low, preliminary, emergency, formal, or any other kind, the whole front of the neck should be split open in the middle line from the thyroid cartilage to the sternal notch, and the trachea should then be laid bare for selection of the proper site for incision. A long incision in the overlying tissues makes the subsequent finding of the trachea, at operation and during the after-care, easy; a largely open wound prevents mediastinal emphysema, and mediastinal infection. A small wound, like one sutured up close to the cannula, introduces dangers in the after-care and invites complications.

Cricoid cartilage should never be cut. Of the thirty surgical textbooks examined, not one warns against dividing the cricoid cartilage. Anyone examining the cartilages of the larynx will see at a glance that the strongest factor in maintaining the laryngeal lumen is the cricoid cartilage, which is a complete ring; whereas the thyroid cartilage, which rests upon it, is incomplete posteriorly. Our clinical experience has been that other factors being equal, the laryngeal stenoses with a perfect cricoid are the easiest cured.

Is high tracheotomy a justifiable operation? In answer to the question raised at the beginning of this article, the author's experience, to various phases of which reference has been herein made, leads him to state that while no one has the right to say that in any given case, the operation that has saved the patient's life was an unjustifiable one; yet in view of the fact that other methods are equally quick, safer, surer, and not so likely to be followed by laryngeal stenosis, high tracheotomy should not be *taught*. There should be taught but one tracheotomy, and that should mean incision of the trachea lower than the first ring, after splitting open the front of the neck. If for haste or any reason a higher operation has been done, a cannula should not be worn in the high incision; but as soon as the patient has re-established his breathing, the front of the neck should be split open and a second incision should be made below the second ring and the cannula worn therein. The first incision should not be allowed to be covered by the tissues until the cartilages have been united by inflammatory tissue. If any of the various trocar-cannulæ for quick high tracheotomy have been used, the same statement applies.

After-care. Numbers 5, 6, and 7 of the above listed tracheotomic causes of chronic laryngeal stenosis may be grouped under after-care. Next to the error of high tracheotomy, after-care of a tracheotomic case seems less understood than anything else in surgery. A general plan of after-care has been elsewhere given.[1] Only a few points need be referred to here. The wound should be dressed every hour, at least, so as to get rid of the secretions that otherwise would furnish a nidus for saprophytes and other bacteria. The latter will be washed away by the flow of serum and secretions if the dressings are renewed often. The wound should be left open, not sutured up to the cannula. We are not concerned in this article with the general dangers of mediastinal emphysema, mediastinal infection, slow asphyxia from a cannula being misplaced after cleaning or lifted out by swelling of the overlying tissues; but with the tendency to slow union of the divided tracheal cartilages. The union is always fibrous, never cartilaginous, and this takes time. Primary union of the overlying soft tissues will often take place promptly; but the cartilages of the trachea, exposed as they are to air infections, never unite or heal by first intention, and are slow to heal over the divided ends when a cannula is used. Exuberant granulations almost always fungate into the trachea, and linger for weeks or months, after the cannula is removed, in temporary preliminary tracheotomies, often ending in a tracheal stenosis complicating a laryngeal one. The wound in preliminary temporary tracheotomies should be kept open with packing until the tracheal cartilages are united by fibrous tissue and the granulations have epithelialized. In cases in which the cannula is to be worn, the wound should be kept open until the divided ends

[1] Loc. cit.

of the tracheal cartilages are covered with epithelialized granulations. Another defect in the usual after-care is the neglect of ordinary cleanliness of the cannula and the wound. The inner cannula should be cleaned hourly or oftener if obstructed. The outer cannula should be removed at least once a day, cleansed, smoothed, polished, sterilized, and fitted with clean tapes. For this daily toilet, duplicate cannulæ should be provided. It seems strange that a surgeon who would not think of not removing his artificial denture at least three times a day, has been known to tell his assistants or the patient that once a week or once a month is often enough to take out the outer cannula. Patients of refinement often come in with a foul smelling cannula from such neglect of ordinary cleanliness. Corrosion and roughening of the tube with decomposing secretions cause chronic localized tracheitis which in time means fibrosis and stenosis, usually, though not always, located on the posterior wall of the trachea.

The prolonged wearing of an improper cannula is often a factor in the development of a chronic tracheal stenosis. Of course the wearing of a cannula is a necessity; but a proper one, smooth, of proper material and properly fitted in shape and size to the patient, has little or no tendency to result in the localized fibrosis that causes stenosis. On the other hand, one that fits badly, or one made of improper material, as aluminum, hard or soft rubber, or one made with the utterly useless fenestra, will cause irritation and subsequent stenosis. The fenestra is useless because a proper cannula, equal in area of cross section to that of the average normal glottis of the particular patient, will have room around it in the trachea to permit an ample by-passage of air, without any fenestra. Roughly, the normal tracheal area of cross section is more than double that of the normal glottis; hence it is unnecessary to have a cannula of more than half the area of cross section of that of the trachea. Many children are brought to the clinic with tracheal stenoses difficult of cure because, in the haste of operation, an adult cannula was put in and not replaced by a proper size afterward. Wearing the oversized tube had caused ulceration of the mucosa, perichondritis, and necrosis of the tracheal cartilages. Often the cannula is worn unnecessarily long because the attendant is not familiar with the partial corking method[1] of weaning the child away from the cannula. Breathing through the neck is so much easier than through the mouth that after a while the child does not want to abandon the cannula, and with the vivid memories of repeated partial asphyxias, becomes panic stricken when an attempt is made to remove the cannula. Partial corking, permitting air leakage through the cannula prevents panic and will quickly decannulate any child who has a sufficient laryngeal airway.

SUMMARY

1. The most frequent cause of chronic laryngeal stenosis is high tracheotomy.

2. While in a given case no one has any right to say that the operation that saved that patient's life was an unjustifiable one; yet, equally rapid methods being available, high tracheotomy should not be *taught*.

3. The classic distinction between a high and a low tracheotomy with reference to the isthmus of the thyroid gland is a relic of the days when too much respect was had for the thyroid gland, or at least for its isthmus, and the distinction should be abandoned. The vitally important matter of where the trachea should be incised should not depend upon the negligible isthmus. There should be taught only one tracheotomy and that should be low.

4. The trachea should always be incised lower than the first ring except in those rare cases in which laryngoptosis renders this impossible without entering the anterior mediastinum.

5. The cricoid cartilage should never be cut unless laryngoptosis places all the rings of the trachea below the upper border of the manubrium, which would require entering the mediastinum if the rule were to be followed.

6. The tracheotomic causes contributing to chronic laryngeal stenosis are:

a. High tracheotomy.

[1] Peroral Endoscopy and Laryngeal Surgery, 1914, p. 645.

b. Hasty operation.

c. Attempts at general anæsthesia.

d. Cutting of the cricoid cartilage.

e. Hacking the trachea by several incisions instead of one.

f. Denuding the tracheal cartilages of perichondrium with resultant necrosis.

g. Suturing the wound.

h. Prolonged wearing of a cannula that is of improper size, shape, or material, such as rubber or aluminum, or one with a fenestra, or one without a pilot.

i. Neglect of proper after-care. The keynote of the after-care should be that it is a plumber's job; the "pipes," natural and instrumental, must at all times be kept clear.

7. If in an emergency a high incision of the trachea has been made, a cannula should not be worn in it. As soon as the patient's breathing has been resumed a low incision should be made and the cannula should be inserted therein.

8. Going deeper, the fundamental cause of so many cases of chronic laryngeal stenosis lies in the faulty teaching in the surgical textbooks. The eminent surgeons who write textbooks would not do a tracheotomy through the larynx to avoid the isthmus of the thyroid gland, or because of haste; but eminent surgeons are not often at hand when emergency tracheotomies are required. These operations are usually postponed until respiration has ceased. If not already stopped the practitioner promptly stops it by attempting to give a general anæsthetic.

In conclusion, the author apologizes for the foregoing constructive criticism of the modern surgical textbooks that have perpetuated the errors of the ages, and offers as palliation the excuse that his life has been largely spent in combating the chronic laryngeal stenoses that have resulted from errors unconsciously committed in faulty, though often life-saving, tracheotomy. And if the language seems to anyone unnecessarily vigorous, his attention is called to the fact that previous milder statements to the same effect have been ignored, utterly failing to check the steady stream of needlessly-created chronic laryngeal stenoses pouring into the clinic. Perhaps, too, the vigor comes as the venting of pent-up thoughts that could be communicated neither to the patient nor even to the respective tracheotomists who had saved the patients' lives. The fault lies not with either of these classes of individuals, but with the surgical textbooks of today, which perpetuate a faulty teaching.

IMMUNITY IN SURGERY[1]

By GEORGE E. ARMSTRONG, C.M.G., M.D., LL.D., D.Sc., F.A.C.S., Montreal, Canada

TWO of the three fundamental problems of surgery, the application of the ligature and anæsthesia, are established on a fairly satisfactory basis. The third immunity demands further study and investigation. The practical importance of recent advances in our knowledge of immunity gives promise of a more thorough understanding of this complex problem in the near future.

In the words of Professor Oertel, fundamental changes in the conception of cell life and cell activity have recently come about through the development and application of physical and colloidal chemistry and a greater refinement in our knowledge of the morphology of cell structure. Primarily of interest to the biologist, physiologist, and pathologist, they have emerged from the lines of theory and pure science and reached a point of practical importance.

It is not my purpose to enter here into a detailed discussion of all the phenomena of cell life as at present conceived, but it seems serviceable to lay before you certain broad generalizations in regard to immunity reactions which are of great interest to the surgeon as well as to the physician.

First, as to the general nature of immunity. It would be, in the light of present knowledge, a mistake to define immunity, as has been done in the past, only as purposeful protection. For we know that not all immunity reactions are protective, as, for example, in anaphylaxis and in that interesting group of diseases which may now safely be regarded as anaphylactic states (hay fever, asthma, many skin diseases, migraine, etc.), and that even in protective immunity certain accompaniments may occur which destroy its protective effect. It is, therefore, scientifically speaking, more correct to define immunity as the sum total of all interactive processes which proceed in an organism when resisting an invasion. Protective immunity is, therefore, only a relative phenomenon, although in the gradual evolution of the species it assumes a growing importance, because only those organisms survive which are endowed with so-called protective reactions, that is, are enabled through manifold endowment to adapt themselves to changing requirements of environment. It is important to remain conscious of this broader conception of immunity, for it places it entirely within the sphere of general biological laws and cell responses irrespective of their desirable or undesirable individual results.

Turning then, secondly, to the mechanism of immunity reactions, we find today very profound changes in our ideas from those which were held only a few years ago. The ideas of Ehrlich which, as we all know, held the whole field for a time, were entirely chemical. He regarded the toxin of bacteria as a definite chemical compound which was neutralized, like an acid by an alkali, or by another chemical compound, the antitoxin, manufactured by the body cells. But we are today very far from regarding this as so simple a process. On the contrary we have learned that the toxin-antitoxin reactions are extremely complicated colloidal phenomena and that toxins and antitoxins are themselves so complex that their chemical entity is quite uncertain. It appears that toxins and antitoxins are very large colloidal combinations, not simple chemical compounds. They are not actually dissolved in the blood, like crystalloids, but rather suspended or emulsified. They unite by selective absorption, and not by simple chemical reactions.

Let me briefly explain this difference (Chart 1). When we have suspended in a medium a number of non-miscible substances (as for instance, colloids in the blood) (*1* and *2*) the surfaces of these substances are in a state of surface tension and work may be done by these surfaces when the tension is able to diminish. At the interfaces of these substances (that is between them) there is, therefore, a local accumulation of free surface

[1]President's address, Clinical Congress of American College of Surgeons, Montreal, October, 1920.

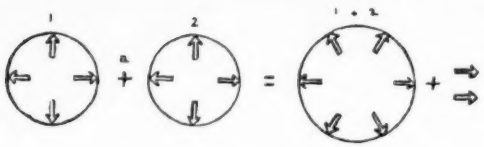

Chart 1. Phenomenon of reduction in surface energy *i.e.*, absorption.

energy and this can be reduced by the deposit of substances with low surface tension at the interface. Consequently, according to a law, formulated by Gibbs and Thompson, it follows that substances which lower surface tension will be concentrated and then precipitated on this surface and the energy will be lessened thereby. Thus colloidal complexes adhere to each other in relation to surface energy. This is, therefore, a physical and not a chemical union, and adsorption is distinct from absorption in which one substance unites with another to lose its identity. Absorption of some colloidal constituents may follow, but this is a secondary matter incidental to adsorption. Adsorption is a very important phenomenon in the relations of colloids and, therefore, also in cell life, and its importance is growing in regard to the relations of the cell to substances with which it enters into combination. Consequently, it is playing a gradually more important rôle in the processes of immunity, for all the substances which we here deal with are colloidal in character. Of this we are certain, although their chemical constitution remains quite obscure. But inasmuch as adsorption in colloids is not, at least not essentially, a chemical reaction, but a physical union, dependent, as we have seen, upon phenomena of surface tension and surface energy only, it possesses a different biological significance from chemical reactions of two compounds. Thus, toxin-antitoxin union is rather a group phenomenon dependent upon physical characters, as contrasted with specific chemical reactions of two substances. It follows, therefore, that immunity reactions are not absolutely, but only relatively, specific. This has been clearly established in the Wassermann reaction and probably also explains the successful cures of certain diseases like rheumatic arthritis, by non-specific, say typhoid, and vaccines. We know that the fixation of the complement in the Wassermann reaction may not only be accomplished by syphilitic serum (that is the so-called syphilitic antibody) but by other colloids (crystals and proteins) of similar physical character. These may occur in the blood after meals, after resorption of extensive inflammatory exudates, in acidosis, and in some other lesions. The opposite has also been established, for withdrawal or solution of these colloids from the blood, as, for instance, through ether narcosis, may render even a syphilitic serum incapable of entering into a positive Wassermann reaction and thus the reaction may be absent in the blood, but still persist in the cerebrospinal fluid. You will at once appreciate the practical importance of these observations, for we must, in order to employ this reaction for the diagnosis of syphilis, guard against the entrance of fat and foreign proteids into the blood which will simulate the syphilitic antibody and we must also interpret the absence of the reaction *cum grano salis* and as influenced by individual circumstances of a case.

Our whole conception of this reaction and its application to practice stands, therefore, today on a very different basis from that of several years ago.

Two other important immunity reactions have recently acquired different explanation and significance: chemiotaxis and phagocytosis.

It will be remembered that these, especially phagocytosis, played an essential rôle in the theories of immunity of Metchnikoff. He went so far as to believe that the ingestion and annihilation of bacteria by cells (phagocytosis) was the principal method of cell defense, and the researches of Wright and his pupils led them to believe that differences in phagocytic action depended upon presence or absence of specific substances, opsonins, which prepared foreign particles for ingestion by phagocytosis; hence the importance of the so-called opsonic index in the blood as index of immunity.

Our ideas have here also undergone decided changes since we know that movement of, and ingestion by, cells are essential surface tension phenomena. Cells suspended in a

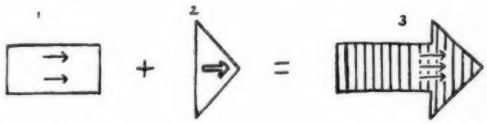

Chart 2. Phenomenon of chemical union. 3, New substance.

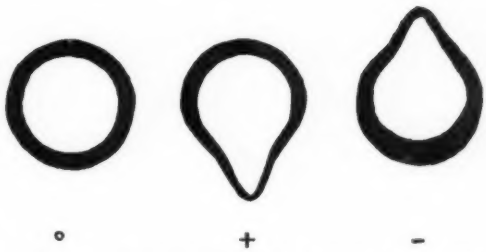

Chart 3. Phenomenon of surface tension, *i.e.*, chemiotaxis.

medium behave as do drops of colloids, and their movements and ingestion of foreign particles depend, not upon chemical affinity, but physical changes in their environment.

A drop of a colloid suspended in a non-miscible or only very gradually miscible medium flows gradually toward an area of lessened surface tension in exactly the manner of a cell (amœboid motion). Movement of cells toward an object is, therefore, the result of *lowering* of the surrounding tension in that direction; movement away from an object, of *increase* of surface tension at one of the peripheral points (Chart 2). The cell rests when surface tension is everywhere equal. Positive chemiotaxis (movement to) (leucocytosis, cell exudates) is, therefore, identical with lessened tension in one direction; negative chemiotaxis (movement away) (leucopænia) with increased tension in a direction.

The very important observations of Rhumbler have further demonstrated that ingestion of foreign particles is essentially also a surface phenomenon. We can duplicate the same phagocytic action which we observe in the amœba in a drop of chloroform suspended in dilute alcohol, provided we offer to the chloroform a substance, like shellac, which is soluble in, or "palatable to," it. Solid particles, like splinters of glass and wood, are rejected by the chloroform as by an amœba or leucocyte.

These observations have been thoroughly well established and they make plain the physical basis upon which both chemiotaxis and phagocytosis rest. Opsonic variations are, therefore, not of specific chemical nature, but general phenomena of surface tension variations.

Thus the significance of chemiotaxis and phagocytosis appears in a new light and does away with the necessity of assuming specific chemical processes and particular purposeful vital acts for them.

The physical interpretation of the phenomena of toxin, antitoxin, and complement fixation and those of chemiotaxis and phagocytosis, which I have very briefly sketched, have brought about a greater uniformity and simplicity in our views of immunity, for they make it probable that the multitude of immunity reactions, which were formerly believed to be due to particular chemical substances and processes for each phenomenon and which have brought forth ideas of numerous hypothetical substances and complicated reactions, may ultimately be grouped and explained by the general laws of colloidal relations.

The point of practical importance is that, as our knowledge advances, the many theories which have been introduced to explain individual immunity reactions give way to applications of general physicochemical laws in conformity with other phenomena of cell life.

ACUTE INTESTINAL OBSTRUCTION[1]

By J. M. T. FINNEY, M.D., F.A.C.S., Baltimore

THIS report is founded upon a study of 245 consecutive cases of intestinal obstruction covering a period of the last 10 years. These cases occurred in the general surgical service (158 cases) and the gynecological service (57 cases) of the Johns Hopkins Hospital, and the surgical service (30 cases) of the Union Memorial Hospital, Baltimore. They were not confined to the practice of a single surgeon but represented the combined experience of a considerable number.

Age has seemed to be no important factor in this series except in patients suffering with intussusception and volvulus. Of the 8 cases of intussusception included in this series, all were under 1 year, with the exception of one case, a boy of 13 who gave a history of having been operated upon a short time previously for two congenital anomalies, a persistent thyroglossal duct, and a Meckel's diverticulum which was discovered and removed in the course of an operation for appendicitis.

Of the 8 cases of volvulus, all occurred in patients in middle life, or past. With one or two exceptions, all of the cases occurred between the third and fifth decades of life.

The factor of sex, however, seemed to make a very material difference. The ratio of male to female patients was in the proportion of 2½ to 1.

The race factor seemed also to play a rather important part, since in the Johns Hopkins series, in which both colored and white were included, the ratio was about 1 black to 1.2 white. This, of course, is a far higher proportion in comparison with the numbers of the respective races admitted to the hospital for all causes. Negroes, then, would seem to be more subject to intestinal obstruction than are whites. The reason for this is probably the high percentage of pelvic inflammatory diseases among the women of that race, since in this series the proportion of females to males in this race was 5 to 4 (64 per cent).

Out of the entire number of 245 cases, 217 were operated on, of which 141 recovered, a mortality rate of 36 per cent. The operations varied from such simple procedures as the untwisting of a volvulus or division of a constricting band to resection of several feet of gangrenous bowel. In studying the different operations performed and the circumstances under which they were done, the result seemed to depend far more upon the condition of the patient at the time of the operation, the length of time that had elapsed since the onset of the symptoms of obstruction, and the condition of the bowel, than upon the nature of the operation itself. Other things being equal, the cases of resection seemed to compare very favorably with the simpler forms of operation. In 117 cases in which the condition of the patient at the time of operation was definitely stated, it was said to be good in 49 as against bad in 68. This would seem to have a very definite bearing on the end-results, as well as to furnish a striking commentary on the effect of delayed operation. In 19 cases, no cutting operation was performed as medical measures, enemata, etc., sufficed. Of these, 17 recovered and 2 died. The reason stated for failure to operate upon these two was a practically moribund condition.

The interval of time between the onset of the symptoms and the operation varied very materially in the acute cases as well as in the chronic. In the latter, it extended in several instances over a period of years. In the acute cases, the shortest interval was 4 hours. The shortness of the interval of time elapsing between the onset of the symptoms and the operation played a most striking part. Of 21 cases, all of acute complete obstruction of various kinds, in which the operation was performed in 12 hours or less from the beginning of the trouble, there were 20 recoveries and 1 death, a mortality rate of approximately 5 per cent. The effect of the time element can be still more strikingly seen by observing

[1]Read before the Clinical Congress of American College of Surgeons, Montreal, October, 1920.

the steady increase in the mortality rate which accompanies the lengthened interval. Thus, the mortality rate in the cases operated on in the second 12 hours immediately advances, as compared with the 5 per cent in the first 12 hours, to 11 per cent, while in the cases operated on in the second 24 hours it increases to 31 per cent, a very striking advance.

The obstruction was stated to be complete in 125 cases, incomplete or partial in 85. It was noted as acute in 144 as against 65 chronic obstructions. There were 50 cases of hernia in the list, all strangulated, of which 40 were inguinal, 6 femoral, 3 ventral, 1 umbilical. There were 14 cases of paralytic or adynamic ileus, all postoperative. Of these, 7 recovered and 7 died. One hundred cases, or 40 per cent, of the total number, had had previous abdominal operations of one sort or another, which seemed in some way to bear a definite relationship to the subsequent development of intestinal obstruction. These operations consisted almost exclusively of either appendectomy or drainage of an appendix abscess, or of some pelvic condition, chiefly of inflammatory origin. The mortality rate in the group of obstructions following strictly pelvic conditions was 50.9 per cent, just over one-half, which bears out the generally accepted belief that pelvic operations, especially for inflammatory troubles, are followed by a very high percentage of intestinal obstructions and that the death rate in these cases is correspondingly high. Of the symptoms usually associated with intestinal obstruction, pain was very constant. It was noted in 204 cases (83 per cent), in most of which it was pronounced, of sudden onset, and usually stated as at first "colicky" or intermittent in character, later becoming more continuous. Nausea and vomiting were present in 197 cases (80 per cent). Constipation more or less pronounced was present in 142 cases (58 per cent). Distention was noted in 119 cases (48 per cent) and visible peristalsis in 50 cases (20 per cent).

The operation of enterostomy was performed 48 times with a mortality of approximately 60 per cent. This seems an unusually high percentage, but it was done in this series only in those cases in which operation had been too long delayed, and usually as a last resort, a quick method of affording possible relief with the least expenditure of time and strength for the patient. Resection of the intestine was performed 30 times, as a rule only in severe cases, where the bowel had been seriously injured, or for cancer. It was usually followed by an entero-anastomosis, occasionally by enterostomy, as conditions indicated. The mortality in this group of 30 resections of the bowel was 10 (33 per cent), which would seem to indicate that in cases where the viability of the bowel was in question, and the condition of the patient such as to justify it, resection of the injured segment was the operation of choice, either with or without enterostomy, preferably with immediate entero-anastomosis.

Multiple operations of one sort or another had been performed in 36 cases. In some of these as many as 4 or 5 operations had been done previously.

Intestinal obstruction, generally speaking, is divided into two classes, acute and chronic. This report has to do almost exclusively with the former, although cases of the latter that have occurred in the surgical service of the Johns Hopkins Hospital during the past 10 years, 65 in number, have been included in our series. These include 24 cases of cancer of the colon, 7 cases of tubercular peritonitis and ulceration, 4 of megacolon (Hirschsprung's disease), 1 of which was associated with an imperforate anus, 1 case of sarcoma of the cæcum, and 1 of carcinoma of the jejunum. The remainder were chiefly due to adhesions following previous operations upon the appendix or pelvic organs. The operative mortality in the chronic cases as a whole is high because of the relatively large number of cases of malignant disease included. Exclusive of these, however, it is low because, owing to the long-continued irritation of the intestine, a certain degree of tolerance to insult has become established, which is lacking in the acute cases.

In studying this series of cases and comparing them with other series that have been reported from time to time, such, for instance, as those of Gibson, Deaver and Ross, McGlan-

nan, Woolsey and others, one gains certain impressions, perhaps the most marked of which is that there is a definite relationship existing between the promptness of the operation after the onset of the symptoms and recovery—the shorter the length of time, the higher the recovery rate; the longer the interval, the higher the death rate. Within certain limits, it does not seem to make so much difference what the nature of the operation or who the operator, as *when* it is done. The next thing that impresses one is the difficulty in arriving at a definite diagnosis in many cases. There is one comforting fact however, namely, that practically all of the conditions with which it is likely to be confused, demand operation almost as imperatively as does intestinal obstruction. Finally, one of the strongest impressions that one gathers from this study, and of great practical importance, is that once the question of possible intestinal obstruction has been raised in a case presenting marked symptoms and becoming progressively more grave, immediate recourse, without unnecessary delay, should be had to a surgical operation.

Any part of the intestinal tract may be obstructed and it may be acute, subacute, or chronic. The obstruction may be complete or in part and may be due to a variety of causes, *e.g.*, intussusception, volvulus, foreign bodies, internal strangulation, enteroliths, intestinal parasites, bands, adhesions, kinks, twists postoperative or not, paralysis, tumors, congenital defects, *e.g.*, megacolon, Meckel's diverticulum, etc. Intestinal obstruction may at times be simulated by various conditions, *e.g.*, typhoid fever, Henoch's purpura, certain infections, appendicitis, acute pancreatitis, angioneurotic œdema, the twisted pedicle of a tumor, lead colic, renal colic, gall-stones, mesenteric thrombosis, diaphragmatic pleurisy, etc., and so is not always easy to diagnose.

Acute intestinal obstruction, while not necessarily fatal, is always a grave condition. The gravity is threefold, it is dependent not merely upon the local obstruction to and arrest of the fæcal current, nor yet upon the interference with the free circulation of the blood in the affected segment of intestine, serious as both of these conditions may become by reason of their inevitable sequelæ, but upon constitutional symptoms the result of resorption of poisonous chemical products from the upper intestinal tract. The nature and effect of these substances will be fully dealt with by another in this symposium and are simply referred to here in passing.

The clinical picture of acute intestinal obstruction is fairly constant and characteristic, although not always so, especially in the postoperative cases. In the group of cases developing obstructive symptoms in the course of a few days after an abdominal operation, the purely obstructive symptoms may be masked by those usual in postoperative conditions. The problem here is to differentiate the two conditions, a not always easy or possible task. Fortunately it is not necessary in these cases to make an absolute diagnosis; the important point is to recognize those cases which do not respond to gastric lavage, enemata, and the proper administration of cathartics, and in which the symptoms are becoming progressively worse, and to reopen the abdomen before irreparable damage has been done. In case of doubt, it is always safer to operate. The determining factors are the intestinal character of the vomitus, the failure of lavage and enemata to relieve the vomiting and tympanites, and an increasing pulse rate with restlessness and thirst.

The passage of the stomach-tube in doubtful cases may furnish valuable information as to the character of the stomach contents, and followed by repeated lavage, may be of great benefit. When it is intelligently used, especially in cases of suspected obstruction following shortly after an abdominal operation, it may prove a means of avoiding reopening the abdomen, or may become a veritable life saver.

The most important and common symptoms of intestinal obstruction are pain of sudden onset, constipation, nausea and vomiting, distention, sometimes asymmetrical. Of especial significance is the presence or absence of shock early in the course of the trouble. If the classical symptoms of shock, more or less pronounced, accompany the early mani-

festation of obstruction, one may be reasonably certain that the segment of intestine involved has been pretty badly used, either tightly constricted or injured in some manner, so that its blood supply has been seriously interfered with and its lumen obstructed. Sometimes the development of these symptoms is progressive, mild at first, and gradually increasing in intensity. Such a clinical picture means that the obstruction had been only partial at first but has now become complete.

Constipation is usually present, but may be preceded by one or more movements of the bowels. In our series of cases, it was frequently noted that the bowels had moved soon after the onset of pain and vomiting, thus emptying themselves of the fæcal matter present in that portion of the intestine below the obstruction. After this had been accomplished, constipation developed. Particularly was this observed in the cases where the obstruction was high up in the intestine. This feature was especially well marked in the group of postoperative cases where the obstruction was more apt to be fairly high than in the cases of volvulus, for instance.

Distention is also a fairly late manifestation. It is more pronounced, as a rule, the lower the obstruction, and in such cases is usually symmetrical. Where the obstruction is high, asymmetry is the rule and tympany is less marked.

Visible peristalsis is rarely observed early, and is usually well developed in proportion to the length of time that the obstruction has persisted. The same is true of borborygmus which seems to be associated with at least a moderate degree of hypertrophy of the intestinal walls.

Pain is very constant and usually the first symptom observed. It is more or less pronounced and is intermittent or "colicky" in character, later becoming more continuous and not infrequently of great severity. The vomitus at first consists of stomach contents followed by bile-stained mucus and fluid from the duodenum and upper intestinal tract, later becoming stercoraceous. Hiccough is a frequent accompaniment of this later stage. Tenderness is largely dependent upon the character and location of the obstruction and, therefore, only exceptionally a marked feature. Tenesmus and movable dulness are only occasional accompaniments of this trouble. As the condition progresses, the patient who at first may have shown few signs of serious illness now begins to develop in addition to his pain and vomiting a certain symptom-complex that is very definite; anxious expression, pallor, cold sweat, sunken eyes, rapid pulse, subnormal temperature, dryness of the mouth, severe thirst, scarcity of urine frequently containing large amounts of indican and excessively high leucocyte count. Death usually supervenes in a few days to a week, if operative or other relief is not forthcoming.

When all of the classical symptoms of intestinal obstruction are present, diagnosis is very easy. Unfortunately they are not always manifest. It is by no means always easy to determine the existence, nature, or site of a given obstruction. By careful attention to the history of the case, however, and close observation and study of the phenomena presented, one is usually able to determine the probable presence or absence of an obstruction with sufficient assurance to decide the question of surgical interference, for after all is said and done, this is the only question of vital importance demanding immediate decision. The rest may be left to be determined after the abdomen has been opened or by subsequent developments, as the case may be. Once there is sufficient reason to suspect the existence of intestinal obstruction, one should not wait for the development of a complete clinical picture. Always to wait for a sure diagnosis before operating is sometimes to lose the golden opportunity to benefit your patient. Better a few unnecessary exploratory incisions on live patients, than a continuance of the long and melancholy roll of hurried enterostomies done on moribund patients.

Certain varieties of intestinal obstruction are more difficult to diagnose than others and, at the same time, more amenable to treatment. This is especially true of foreign bodies, such as gall-stones or intestinal parasites impacted in the lumen of the bowel.

Intussusception is fairly easy of diagnosis. The passage of bile-free mucus tinged with blood and accompanied by marked tenesmus and a sausage-shaped tumor in the abdomen of a young child previously healthy, points pretty surely to a case of intussusception. While the sudden onset of colic-like pains in a middle-aged or old person who had previously been troubled with constipation, accompanied by early and very marked distention of the abdomen, suggests strongly a volvulus of the sigmoid.

Among the calamities of surgery is to be classed postoperative intestinal obstruction. After a patient has undergone the mental and physical strain attendant upon a severe surgical operation, and has just begun to feel the satisfaction and physical benefit consequent upon having passed safely through such an ordeal, to be called upon again to submit to further surgical procedures, it may be of even greater severity and more hazardous than before, is to stretch almost to the breaking point the equanimity and fortitude of the patient, as well as to tax to the uttermost his powers of physical endurance. Every operating surgeon sooner or later feels the disappointment and chagrin of such a situation. This experience fortunately does not come so frequently today as formerly, thanks to better methods and wider knowledge. In the early antiseptic days, within the recollection of some of us, when it was the custom to handle the peritoneum none too gently with ungloved hands, to irrigate it with strong antiseptic solutions and to stuff the peritoneal cavity here and there with unprotected iodoform gauze drains, it was a not uncommon experience to see develop during the early days of convalescence from an abdominal operation, symptoms of intestinal obstruction of varying degrees of intensity. Even now in these latter days, in spite of great advances in surgical technique, one occasionally meets with this complication.

Think what it means to the patient, the victim of such circumstances! Think of what it means to the good name of our profession, and what it means in the way of additional anxiety and worry to us personally! It behooves us surgeons, therefore, to exert ourselves to the utmost to prevent such occurrences and to save our patients from having their lives again put in peril, it may be from some error in technique or some fault of ours. Here as elsewhere prevention is far better than cure. It is quite possible, indeed probable, that the occurrence of postoperative obstruction cannot be entirely prevented. It is a common belief that, at least temporarily, adhesions take place between adjacent peritoneal surfaces every time the abdomen is opened. Probably the most of these adhesions absorb, or in some way disappear in course of time in those cases where there is prompt and complete healing. Where, however, there is a continued irritation, for instance, a low grade inflammation from whatever cause, these adhesions will not disappear but will be found to have become organized, and often dense fibrous bands will result. These are a not infrequent cause of the obstructions occurring late. The early ones are due to localized peritonitis, the result of infection of the wound tract, or not infrequently to foreign bodies such as drains inserted at the site of the operation. These drains, especially unprotected absorbent gauze stuffed in large quantities into the wound, are productive of extensive adhesions along the drainage track and which in turn, under favoring conditions, may give rise to intestinal obstruction.

Statistics vary in different clinics but it is safe to say that approximately one-half of the cases of intestinal obstruction occurring in both hospital and private practice have their origin in adhesions resulting from previous operative procedures. Why is this? Is it because of the circumstances inseparably connected with any mechanical procedure involving the opening of the abdominal cavity and the handling of peritoneal and raw surfaces? Or is it inherent in the very conditions themselves necessitating the abdominal operation? Is it due to faulty technique, giving rise to undue trauma of the tissues, or to infection or the presence of foreign bodies, such as drains left in the tissues and causing continued irritation to the peritoneum, or to some combination of these forces? So far, there has been no satisfactory explanation

of some of the phenomena observed. Everyone is familiar with the fact that in many cases where one could reasonably expect adhesions to form, few, if any, do, while in other cases, without apparent reason, many and dense adhesions form and persist. Whatever may be the real reason for this, it is probable that the two most potent factors at work are the presence of a persistent low-grade inflammatory process, the result of infection and the presence of some foreign body in the tissues. The potency of the latter factor is abundantly proven not only experimentally but by the marked reduction of late years in the relative number of post-operative cases as compared with formerly, due largely to the better observation of fundamental principles, *e.g.*, gentle handling of tissues, surgical cleanliness, discontinuance of the use, as drains, of large amounts of unprotected gauze and repeatedly removing and replacing it, thus causing unnecessary insult to the tissues and stimulating the formation of excessive scar tissue.

This fact should be borne in mind at all times by the surgeon in performing any kind of an abdominal operation. By so doing, undoubtedly a certain proportion of cases of subsequent development of troublesome post-operative adhesions and paralytic ileus may be prevented.

Not much dependence can be placed in artificial aids, such as the application to the peritoneal surfaces of ointments or membranes and the like. Frequent change of position after operation and the early establishment of peristalsis by means of pituitrin promise more, perhaps, than anything else at present.

Paralytic or adynamic ileus in some degree is probably of more common occurrence than is usually believed to be the case. Fourteen cases more or less well marked were observed in this series, all postoperative, and all following operations upon the appendix or pelvic organs. Differential diagnosis between paralytic and mechanical obstruction is not always easy. Operations upon the kidney and urinary tract are generally believed to be especially subject to this sequel. At first, these cases do not look especially sick, abdominal pain is not marked, nor is the pulse rate much increased, nor is there any evidence of shock. Vomiting is early pronounced but does not usually persist and is regurgitant in character with little or no nausea. The vomitus is at first copious and consists of fluid mixed with mucus, later of intestinal contents with a fæcal odor. After several days, in the favorable cases, the vomiting reappears, which is always a favorable sign, as indicating a beginning re-establishment of gastro-intestinal activity. The pathology of this condition is still in doubt. But the character of the anæsthetic used formerly considered of importance, does not seem to play an important part. Infection is generally believed to be the most constant etiological factor, but it has not been our experience. The picture in the well developed cases is rather that of a true paralysis of the sympathetic nervous system.

Finally, let us be fair with our patients and ourselves. It is foolish to say, as one hears sometimes, that under no circumstances should any form of cathartic or morphia be given in intestinal obstruction. In this series, 17 cases (6.9 per cent), in which well marked symptoms of obstruction were present, recovered under medical treatment without operation. It does not do to generalize too much. The problem that we, as surgeons, have presented to us is this: to differentiate the cases that do not need surgical operation from those that do, and to give this latter class the benefit of surgery at the earliest possible moment, and not to subject the former class to an unnecessary operation. This can only be done by a careful study of each case by itself and by the exercise of due care and discretion in the use of the less radical measures until convinced of their inefficiency. This will call for the exhibition upon the part of the surgeon of that rarest and highest of all qualities, good judgment.

CONCLUSIONS

1. Difficulty may be experienced in making a diagnosis, especially in postoperative cases.
2. Definite diagnosis is not necessary before operative measures are begun.
3. Early diagnosis is the most important factor in the whole category. It is better that

the operation should be done early than well. Better a poor operation done on a patient in good condition, than a good operation done on a patient in poor condition.

4. One is too largely influenced perhaps, in delaying operation in the postoperative cases, by the fact (a) that the patient has just gone through a major surgical operation and both he and the surgeon dislike exceedingly to submit again to that trying ordeal; (b) that so many cases, comparatively, have symptoms strongly suggesting intestinal obstruction, especially after certain forms of abdominal operation, and recover completely after rest, gastric lavage, starvation, enemata, and medical treatment, that the temptation is strong to postpone the operation unduly in the hope that relief may be afforded through these means. Hence often valuable time is lost in this way, and when operation is finally decided upon, it is too late.

OBSTRUCTIONS OF THE COLON AND ILEOCÆCAL REGION[1]

By CHARLES H. PECK, M.D., F.A.C.S., New York
Surgeon to the Roosevelt Hospital

IN reviewing the work of the second surgical division of the Roosevelt Hospital since January 1, 1910, a total of 9,268 operative cases, we have found records of 138 cases of obstructive lesions of the colon and ileocæcal region. This represents a service of approximately 1,050 operations a year, the diminished total being due to the fact that during the war for a period of 19 months the entire operating staff of the division was in military service, mostly overseas, and the division as such ceased to functionate, the work of the hospital during this time not being included in this report. Lesions of the rectosigmoid and rectum are excluded, the gut from the terminal ileum to and including the sigmoid only, being considered. The cases fall naturally into two main groups: non-malignant, 103 cases; and malignant obstructions, 35 cases.

I. *The non-malignant* may be subdivided into—

	Cases
1. Postoperative conditions	26
2. Postinflammatory and congenital bands and adhesions	58
3. Diverticulitis	8
4. Tuberculosis of cæcum or colon	8
5. Megacolon	3
Total	103
6. Herniæ of colon (obstructed or strangulated cases, number not compiled).	

Of the 26 postoperative cases, some presented serious conditions, difficult to deal with by secondary operation, but there were many in which the procedure was easy, and the outcome satisfactory. One patient had had six previous operations, beginning with appendicectomy and repair of the ileocæcal valve. One of the later procedures consisted in the formation of a jejunosigmoidostomy with an opening at least 3½ inches long and subsequent great loss of nutrition. We have operated twice on this case, the first time taking down the jejunosigmoidostomy and short circuiting a tight stricture of the ileocæcal valve; the second time doing a resection of the right colon for narrowing of the short circuit opening and complete occlusion of the normal ileocæcal opening. The loss of nutrition and the obstruction have been relieved, but a small fæcal fistula and much abdominal pain and general misery persist. Another case presented such a tangle of adhesions involving the ileocæcal region and ascending colon, with obstruction, that resection was performed, the operation proving so prolonged and difficult that death from postoperative pneumonia resulted.

In contrast to the difficult type, we have met with many cases in which division of omental or peritoneal bands has been comparatively easy and free from risk, and encouraging relief of symptoms has followed the secondary operation. Omental bands were

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present in 22 cases of this group, and peritoneal and intestinal adhesions in all.

It has been our belief for many years that iodine, swept into the abdomen from the skin surface by the hands of operator or assistants, was responsible for many postoperative adhesions that would not have otherwise occurred and we have previously cited cases which would tend to support this view. Recognition of this cause as a possible factor in peritoneal irritation and adhesion formation, proper routine towel protection to the wound edges, and frequent rinsing of the gloved hands (not in bichloride solution) before handling peritoneal surfaces, should eliminate this danger.

A common type was adhesion of omental bands to the peritoneal surface of an abdominal wall cicatrix, to the pelvic organs or the gut and parietes in the right iliac fossa. These bands tend to shorten and thicken as time passes, and in addition to direct pressure on portions of the gut, the drag on the transverse colon and its fixation constitutes a real symptom producing lesion. Pain is apt to predominate over symptoms of obstruction, but the normal action of the colon is seriously interfered with. We have found this a definite factor in the pathology of 19 postoperative cases and 4 which had had no previous operations. Postoperative peritoneal bands and adhesions are multiform in type and difficult to classify, but most commonly affect the terminal ileum and ileocæcal region. They range in severity from the difficult type already referred to, to simple cases, easily corrected. The presence of fæcal fistulæ or intraperitoneal abscesses, greatly complicate the secondary operation. We have performed two successful ileocæcal resections for such cases, but the procedure was difficult. There was one death in the series from postoperative pneumonia (the case already referred to).

II. *In pre-operative* group, we have found—

1. Postinflammatory omental and intestinal adhesions;
2. Jackson's membrane;
3. Lane's kink;
4. Peritoneal bands obstructing the colon in which no previous inflammatory lesion could be demonstrated;
5. Adhesions associated with a Meckel's diverticulum.

The omental bands were of two general types, the first of the type described in the postoperative cases, fixing and dragging on the transverse colon, or constricting parts of the intestine.

The second group we believe to be a distinct pathological entity, occurring most often perhaps, but not always, in obese patients. In this type the right lateral portion of the omentum is adherent to the line of the ascending colon and cæcum, and the right lateral parietes. There were eight of these cases in our series. The omentum appeared thickened and contracted as though the result of a chronic infection or irritant, probably originating in the colon itself. The difference between the affected part and the normal central and left lateral portions was striking. Pain and discomfort were the predominating symptom, though there was also marked interference with the action of the colon. This type is capable of producing symptoms of sufficient severity and persistence to warrant operative interference, when no other lesion is present.

There were in all 38 cases of omental adhesions, 16 not previously operated upon and 22 postoperative; 23 of which were associated with intestinal adhesions of varying extent.

Jackson's membrane and Lane's kink. We have noted 25 cases of Jackson's membrane and 29 cases of Lane's kink. In 4 of the cases both conditions were present. These were chiefly culled from observations in 439 personal cases of chronic appendicitis, in which, during the past 5 years, systematic examination has been made for bands of this type. Only cases in which the bands were sufficiently short and tense to produce real partial obstruction were recorded. The typical Jackson's membrane we found to be short, tense, peritoneal bands, usually attached to the ascending colon at its anterior longitudinal band, fixing and constricting the gut to a varying degree and rotating it to the right on its long axis, often from 60° to 90°. No one who has seen the colon snap forward into its normal position on division of these bands, can doubt the real obstructive nature of this lesion, nor its interference with normal propulsive peristalsis.

Lane's kinks vary from the types which produce only moderate fixation and angulation of the terminal ileum to short tense bands which seriously interfere with the function of the gut. While we do not believe in exaggerating the importance of these two types of bands, we do feel that they are definitely obstructive and pain producing in a certain number of instances, and that systematic examination for them should be made in all operations for chronic appendicitis, or explorations of the right abdomen.

We have seen a few cases of abnormal peritoneal bands apparently congenital or not directly due to inflammatory processes, crossing the colon in such a way as to produce partial obstruction in the region of the splenic flexure and descending colon. One case of this type, a man 59 years of age, operated upon for gradually developing obstruction which had become almost complete, with great distention, showed such enormous dilatation of the transverse and ascending colon, that the peritoneal coat had cracked in a longitudinal direction in several places. Division of the bands crossing the splenic flexure was followed by prompt and complete recovery.

Diverticulitis. There were 8 cases of sigmoid diverticulitis, verified by operation with 6 recoveries, and 2 deaths from diffuse peritonitis. One of these cases first sought relief for a fæcal fistula in the vagina, which proved to lead through the stump of the cervix uteri, following supravaginal hysterectomy done 12 years before the fistula appeared. In another case a lumbar abscess simulating perinephritic abscess, had formed. Three had extensive diffuse peritonitis when first seen, two being fatal, and in the remaining three local abscesses were drained. Several additional cases were recorded in which the clinical syndrome was distinct, but which were not verified by operation.

Tuberculosis of the colon. There were 8 cases of tuberculosis of the cæcum and colon, 3 of which were treated by radical operation, with two recoveries and one death. In one case exploration and excision of a fistulous tract was performed. In two exploration only, as the extent of the colon involvement forbade radical operation. In the two remaining cases the diagnosis of tuberculosis of the cæcum and ascending colon was made, but not verified by operation. Diagnosis is generally not difficult, as the clinical syndrome and X-ray findings are as a rule pathognomonic.

The most favorable type, of which case No. 1455 (well 9 years after ileocolic resection) is an example, is the hypertrophic type, the one most difficult to differentiate clinically from carcinoma.

Megacolon. We have observed three cases of giant colon, only one of which was subjected to radical operation. This case, after an unsuccessful short circuit operation (an anastomosis between the right half of the transverse colon and the lower sigmoid, which remained for 3 years widely open enough to admit four fingers, but failed to relieve the fæcal stasis), came to resection 3 years later with removal of 4 feet of transverse and descending colon and sigmoid, as large as a man's arm, prompt recovery and relief following. It was the greatest bulk of intestine, though not the greatest length, which we had ever removed. Of the other 2, one was observed in the course of an operation for chronic duodenal ulcer; the other in an exploration for supposed organic obstruction. The latter, a physician, now gets along in comparative comfort with the aid of catharsis and enemas.

Herniæ. Herniæ are mentioned in passing only, and the cases in this group have not been compiled or included in the totals. They consist chiefly in obstructions of the transverse colon, in umbilical or ventral herniæ, and cases of very large herniæ in which the obstruction of the colon is only a subordinate part of the pathology.

II. *Malignant neoplasms.* There were 35 carcinomata of the cæcum and colon; excluding the rectosigmoid and rectum, distributed as follows:

	Cases
Cæcum	3
Ascending colon and hepatic flexure	12
Transverse colon	3
Descending colon and splenic flexure	5
Sigmoid	12
Total	35

Cases diagnosed clinically, but not verified by exploration, have not been considered. Of

the 35 cases, 18 were treated by radical operation with 15 recoveries and 3 deaths; a mortality of 16.6 per cent. Of the 15 recoveries, 12 are alive and well at the following postoperative periods:

Years	Cases
10	2
9	2
7	1
5	1
3	1
1 or less	5

Seven or 46 per cent of the cases which recovered from the operation are well more than 3 years. One lived 18 months and died of recurrence. One had a secondary operation for local recurrence 5½ years after the primary operation, dying of the disease some months later. The remaining cases were advanced growths with secondary deposits, two of them with perforations and intraperitoneal abscess, in which only palliative or exploratory operations were possible.

In dealing with malignant growths, those reasonably movable, without metastasis, or with secondary deposits limited to adjacent accessible glands or omentum, should be excised, the general condition of the patient permitting.

Radical excision should not be done without preliminary colostomy in the presence of any considerable degree of obstruction with distention of the proximal gut. While closure of both segments and lateral anastomosis was formerly the operation of choice, end-to-end anastomosis, even in ileocolic resection, is becoming more and more our routine procedure, and we believe gives better results. The Mikulicz two-or-three-stage operation is of great value at times and is employed frequently by some of our operating staff. Short circuit operations may prolong life with a degree of comfort for some months and are useful procedures in selected cases. There was only one such case in our series. There were 8 cases of palliative colostomy, a necessary procedure at times for advanced obstruction, but one which should be deferred as long as possible if there is no hope of later radical operation.

ENTEROSTOMY IN THE TREATMENT OF ACUTE INTESTINAL OBSTRUCTION[1]

By JOHN E. SUMMERS, M.D., F.A.C.S., Omaha, Nebraska

PERHAPS it might not be inappropriate to refer to the history of the surgical attack in acute intestinal obstruction, leading up to the operation of enterostomy as we know it today.

In 1676 Paul Barbette, of Amsterdam, advised opening the abdomen in obstinate volvulus and intussusception.

Nucke, the anatomist, had this operation carried out successfully in a case of intussusception only a few years later.

It was not until 1772 that Renault performed the double operation of gastrotomy (abdominal section), and enterostomy. Briefly, the circumstances were these: "A young man had been operated upon for strangulated hernia under hopeful conditions, when several days after the operation, without any external appearance of the hernia, symptoms of internal strangulation presented themselves. Renault, without hesitation, cut into the abdomen. As he found that the small intestine was strangulated throughout a certain part of its course, he made an artificial anus. The operation was successful: on the twenty-eighth day the fæcal matter passed by its normal outlet; and the wound was completely cicatrized." (Trousseau.)

Although several French surgeons successfully practiced abdominal section for intestinal obstruction in both the small and large intestines, it was not until 1838 that Langier recommended the operation of enterostomy when the symptoms of intestinal obstruction continued after the supposed successful reduction of a hernia. In 1844 this procedure was carried out. As symptoms of intestinal strangulation developed, the next day after the operative reduction of a hernia, Maisonneuve re-opened the hernia wound and established an enterostomy. The intestine was obstructed by a band in the neck of the sac. "There was perfect and rapid recovery." However, it is to Nélaton that we owe the firm establishment of the procedure of enterostomy as a life-saving measure in the treatment of acute intestinal obstruction, and the operation was, and still is, known by his name.

First, in 1858, and again 7 years later, Nélaton successfully performed enterostomy. Both of the patients presented all the symptoms of advanced intestinal obstruction, *viz.*, great abdominal distention, fæculent vomiting, etc. Each patient recovered with the artificial anus closed. The technique of Nélaton's operation is the making of a small abdominal incision in the right iliac region, such as for appendicitis, and suturing into the wound the *first* coil of distended intestine which presents itself. The bowel is either opened immediately, or some hours later, according to the urgency of the symptoms.

This type of operation continued to be performed both for mechanical ileus and ileus complicating peritonitis cases, or following abdominal operations, until it was proven that glass tubes (Paul's) or better still, rubber tubes, could be so tied or sutured into the intestine as to drain the bowel effectively and later be removed, allowing the opening in the intestine to close, thus doing away with the nuisance of an intestinal fistula not infrequently necessitating a second operation for its closure.

In general I think it may be said today that in serious cases of acute intestinal obstruction, surgeons (1) make a primary enterostomy as a life-saving procedure to be followed later, if necessary, by an abdominal section to find and relieve the cause of the obstruction. (2) They do a combined operation, making an enterostomy opening in a coil of distended intestine after the successful removal of the cause of the obstruction; this being done for the purpose of securing a safer convalescence. (3) They have still further broadened the field and a peritonitis ileus is included in the indications for operation; the focus causing the peritonitis is removed

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(as a gangrenous appendix), and through the same incision a coil of distended intestine is opened and drained; the distended intestine is drained through a rubber tube fixed into it by a purse-string suture, and in all instances the first or most accessible coil of distended intestine is selected for this purpose —Nélaton's advice. When there is an acute obstruction in the sigmoid or rectum, a cæcostomy is done in the same way as a life-saving measure and as preliminary to the removal of the cause of the obstruction, particularly if this be a new-growth. Nothing essentially different from what I have written can be found in our textbooks or in the general practice of surgeons throughout the world, and without question the practice is sound. It is rightly claimed that the cause of the high mortality in acute intestinal obstruction (about 50 per cent) is due to the fact that operation for one reason or another is performed too late. This is true, but even when performed late I am of the opinion that the mortality can be greatly reduced if the principle of a properly performed and properly located enterostomy can be carried out.

Victor Bonney in 1910, published a paper advising that, instead of following out Nélaton's injunction, *i.e.* "to open the first coil of distended intestine for the enterostomy procedure," the *jejunum* be opened for this purpose. As I have stated in a recent paper on acute intestinal obstruction, Bonney divides the obstructed intestine into three segments: the lower, middle, and upper; the lower more or less collapsed, the middle containing gas, the upper containing fluid. My experience is that the lower and middle segments contain gas chiefly; the upper segment most of the fluids.

The character of the vomitus indicates the height of the fluid-containing segment; when fæculent, the stomach is the highest part. At first in all types of obstruction whether in the small or large intestine, the vomitus is simply the stomach contents; later, in all types, the vomitus becomes fæculent and the stomach and jejunum are in "the segment of toxicity."

"This upward extension of the limits of the fluid-containing segment is due to a rapid upwardly extending infection of the canal by organisms of the lower intestine." (Bonney.) The current in the intestinal tract has become reversed and the drainage must be established in the highest, fluid-containing segment.

Hugh McKenna, December, 1913, reported some animal experimentation and clinical cases supporting the value of a jejunostomy for the relief of ileus. He used the Bonney technique. The enterostomy was done chiefly on the theory of draining the toxic elements in the duodenum.

Mr. W. Sampson Handley, May, 1915, and October, 1915, in articles entitled "Ileus Duplex," by which he means an ileus due to a pelvic peritonitis secondary to an infection (for example, of the appendix or fallopian tubes), recognizes a paralysis of the pelvic coils of the ileum and of the colon, and recommends for its treatment the making of an ileocolostomy or ileosigmoidostomy combined with a cæcostomy. He discusses fully Bonney's recommendation of a jejunostomy, but prefers his own procedure in the type of obstruction under consideration; he recognizes the worth and possible great advantage of the jejunostomy where the evidence of paralysis of the bowel is marked by great abdominal distention and vomiting. In April, 1916, Mr. Victor Bonney published a paper *again* recommending jejunostomy in intestinal obstruction when the character of the vomitus is intestinal or fæculent, and said the drainage should be in "the segment of toxicity." The positive proof of the value of a jejunostomy in the circumstances is that the drainage of the jejunum causes an immediate cessation of the vomiting. For some unknown reason Bonney, in making his jejunostomy, still adheres to the Nélaton type of enterostomy, a type which frequently requires a second operation for its closure, a type in which the jejunostomy permits of the wastage of stomach nourishment through the fistulous opening. Doctor A. I. MacKinnon, in a paper published in December, 1917, recommends strongly the doing of a simple modern jejunostomy for the drainage of the intestine, such a jejunostomy as is made for the nourishment of a patient. He carried out this opera-

tion for the first time, January 21, 1916 (using a double purse-string suture), and has since done a number of them. His work has been successful and is a forward step. The jejunostomy may be done for advanced cases of intestinal obstruction of any type by using a simple technique: a relatively high left rectus incision for drainage through a large-sized catheter introduced into the jejunum and fastened in position by a double purse-string suture. The catheter comes away after a few days and the opening in the bowel and abdominal wall soon closes. Although I am a strong advocate of this procedure and have practiced it a number of times I feel sure from personal experience that unless the vomitus is frankly fæculent, the drainage tube should be introduced into the highest segment of the bowel that is distended, and not into the highest part of the jejunum if not distended, and this can be recognized if an abdominal section has been made to determine the cause of the obstruction. It can likewise be recognized through a proper incision for the exposure of the jejunum near its origin. If, in a search for the obstruction, the small bowel is found much distended, it can *always* be proved that the coils farthest away from the obstruction are heavy and contain much liquid; that those nearest the obstruction are light and contain mostly gas; the heavy coils should be opened in several places to evacuate their contents, and it is sometimes very wise to fasten the drainage catheter by an invaginating technique, into the highest opening made for relief of the distended gut; the other openings are, of course, sutured.

Local anæsthesia, aided by gas if necessary, should be employed in making an enterostomy.

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THE TOXIC AGENTS DEVELOPED IN THE COURSE OF ACUTE INTESTINAL OBSTRUCTION, AND THEIR ACTION[1]

By HARVEY B. STONE, M.D., F.A.C.S., Baltimore

WITHIN the past decade, various phases of the problem of intestinal obstruction have furnished a field for extremely active experimental study. Numerous individual workers, groups, and laboratories, have made contributions from the surgical, chemical, physiological, and pathological view-points, and a very considerable volume of work, nearly all of which is American in origin, has accumulated. A glance backward at the state of our knowledge 10 years ago, as compared with today, will yield a good general impression of the results obtained.

It is safe to say that in 1910, beyond the fact that acute intestinal obstruction was a highly dangerous and often fatal condition, there was no accurate knowledge of why or how this was true. Various theories, based on no particular facts, enjoyed varying degrees of popularity. Thus infection, disorganization of the nervous mechanism, and intoxication were jointly or severally held as actual cause of death. With the beginning of experimental research, certain new theories were advanced. Thus Murphy and Vincent (1) came to regard interference with the circulation of the obstructed intestine as a vital factor in the production of the symptoms of ileus. On the other hand, Hartwell and Hoguet (2) arrived at the conclusion that the large exudation of fluid into the lumen of the bowel, with consequent desiccation of the body tissues generally was perhaps the fundamental mechanism which was responsible for the serious nature of obstruction. A more intricate explanation was that suggested by Draper (3), that the secretions of the upper intestinal tract were toxic but normally were neutralized or detoxicated by the mucosa of the lower portions of the tract, and that in obstruction this neutralization failed to occur with consequent absorption of toxic material. Still another view was advanced by Sweet (4), who surmised that some alteration of the activity of the pancreas or its relations to the intestine might be a responsible factor in the serious results of intestinal obstruction.

In a series of publications by Whipple, Bernheim and the present writer (5), a large number of experiments were recorded on the basis of which the following conclusions were adduced. In dogs with obstructed loops of bowel, death results directly from intoxication, and is not dependent upon nervous disturbances, circulatory obstruction, or desiccation. The toxic material found in obstructed loops, when injected with proper technique into normal dogs causes death with characteristic symptoms reproducing the picture seen when the bowel itself is obstructed. This toxic material is formed independent of food substances or of the secretions of the stomach, liver, or pancreas. Certain further conclusions were reached, which have been questioned by other investigators. These will be considered in more detail as they concern especially the nature and origin of the toxic material. The opinions just set forth, however, have been confirmed by many others, are sustained by conclusive evidence, and may safely be accepted as established. So that one may affirm with assurance that the diversified and hypothetical explanations that were invoked 10 years ago to account for death resulting from acute ileus have been supplanted by the scientifically sustained and generally accepted belief that such death is due to an intoxication originating from the obstructed bowel. Obviously this is a step of great importance in both the theoretical and practical consideration of intestinal obstruction.

This brings one to the direct subject of this paper: what are these toxic factors, whence and how are they derived, and what is their effect? The active controversy that preceded the general acceptance of the toxic theory of the cause of death has been succeeded by almost as continuous a discussion of the

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nature and source of the toxins. In the work of Whipple, Bernheim, and the present writer, certain facts about these toxins were established and certain conclusions concerning them were drawn. The facts may be presented briefly as follows. In obstructed loops of intestine, so prepared as to contain no food, bile, gastric or pancreatic juice, there is formed a material that when diluted, autolyzed, sterilized, filtered, and then injected intravenously in healthy animals produces a characteristic effect. This effect is characterized by a profound drop in blood-pressure, general collapse, fall in temperature, salivation, vomiting, and profuse diarrhœa, which is often blood-stained; at autopsy, splanchnic congestion is the conspicuous feature, which shows especially in the villi of the duodenal and jejunal mucosæ. The toxic material is found not only in the intestinal contents, but in the mucosa of obstructed loops. The toxic material is not absorbed from the normal mucosa of unobstructed dogs. From these facts it was inferred that the toxins are formed either from action of bacteria or action of the mucosa or its enzymes, since all other causal agents could be eliminated. Some of the evidence evoked led to the conclusion that the mucosa, from some perversion of its function under obstruction conditions, was the source of toxin production and that the toxin found in the lumen was excreted from the mucosa, whereas the symptoms observed were due to that portion of the toxin taken up by the blood-stream from the mucosal cells direct. This point of view has been sustained by Whipple (6) in numerous publications since the articles referred to above.

This opinion, however, has not been unassailed. Murphy, Brooks and their associates, working at George Washington University, had come to the conclusion that the action of bacteria was the essential agency necessary for the development of toxic substances in the obstructed bowel. This view has been strongly supported by the Dagstedts (7), Moorhead, and others at the University of Chicago. They have published a series of articles bearing upon various questions in the study of experimental obstruction and from one of them the following conclusions may be quoted. "(1) Closed loops of bowel freed from bacteria are compatible with life. (2) Closed loops with bacteria but without tissue necrosis are compatible with life. . . . (5) Experiments do not support the Draper theory of a normal toxic secretion from the duodenum, nor the Whipple theory of a perverted secretion under obstruction conditions. (6) Bacterial activity plus necrotic tissue or the absorption of toxic products resulting from the action of putrefactive bacteria on necrotic tissue is the important factor in the rapid death in simple closed intestinal loops." In an effort to assess the importance of the mucosa in the production of toxins, Davis and the present writer (8) deduced from their experiments the following opinions: The secretions of the normal intestine when fresh are not toxic; this secretion when kept under conditions that inhibit bacterial growth remains non-toxic; this secretion when collected and kept free from external contamination, but incubated so that its own bacterial content may grow, develops *in vitro* within 18 hours, toxic properties producing symptoms like those of fluid from closed intestinal loops. These experiments render it unnecessary to assume the presence of the mucosa itself in the production of toxic material. While the activity of digestive enzyme of mucosal origin could not be definitely excluded, the strong impression was made that bacterial activity in the presence of a protein substrate is the source of origin of the toxins of obstruction.

The exact nature of the toxins has also been a matter of dispute. Practically all are agreed that these substances are derived from the splitting of protein molecules. Sweet, Peet, and Hendrix (4) point out that in the series of degradation products of protein or similar large molecule substances, toxic effects are produced by the proteose groups and the amine group, while the fat-splitting enzymes produce from lecithin the toxic cholines and neurines. They would look, therefore, to find the toxins of obstruction in the class of proteoses, amines, or cholines and incline to the importance of the proteoses. Whipple (6) has steadily maintained that intestinal

obstruction is a proteose intoxication, originating as stated above from a perverted action of the mucosa. He has been able to isolate in a fair state of chemical purity from the loop fluid of obstruction cases, both human and canine, a substance which he has studied extensively. He reaches the conclusion that this is the chief toxic factor in death from intestinal obstruction, that it has the chemical and biological properties of a proteose, and that a degree of experimental immunity can be developed against it. As against this view, stands the opinion of Dagstedt's and their collaborators, who take issue in every particular except the primary one of the existence of a toxin. As a result of their investigation they are led to the opinion that the lethal substances are toxic amines, produced by the action of bacteria on proteins and their split products, and that no demonstrable immunity can be developed against them. Other investigators have reported the finding of neurines and cholines. For one not a physiological chemist to pass critically on these rival opinions is little worth while. It must be admitted that Whipple presents clear and convincing proof of the obtaining of a toxic proteose, and nothing in the work of other workers has contraverted this. The suggestion naturally arises that the rival opinions are in no sense contradictory. From the writer's previous work in association with Whipple, and his more recent work with Davis, the opinion has grown that a whole series of toxic split-products comprising representatives of both the proteose and amine groups is no doubt present in the bowel in intestinal obstruction, and quite possibly active in the lethal results. An interesting side-light is thrown upon the chemical side of the obstruction problem by an article of Abel and Kubota (9) upon an entirely different subject. In a study on the presence of histamine in the hypophysis cerebri and other tissues they suggest that histamine, which may be formed by bacterial action, or otherwise, and which in large doses causes depression of the circulation and shock-like prostration, is daily present in the alimentary tract and plays an important rôle as stimulant for the gastric and intestinal musculature and also as a dilator of capillaries during digestion.

Whatever the difference of opinion as to the precise chemical nature of the toxins produced in obstructed bowel, there is unanimity of findings as to their result. In the original paper of Stone, Bernheim, and Whipple (5), it was reported that when the toxins were introduced into the circulation of normal dogs, there followed a marked and rapid fall in blood-pressure, temperature disturbances, excretion of large amounts of fluid into the intestinal canal, with vomiting, diarrhœa, sometimes bloody, and fatal shock. At autopsy a marked engorgement, due to vascular dilatation of the mucosa of the digestive tract, especially the duodenum and upper jejunum is found. Whipple has continued to study the effects of the toxic substances, with publication, from time to time, of his findings. Of particular interest to clinical surgeons is the recent article of McQuarrie and Whipple (6) describing a definite impairment of the excretory function of the kidney associated with the intoxication of intestinal obstruction. As this impairment, measured by the rise of the non-protein nitrogen of the blood, parallels the degree of intoxication, it furnishes a chemical test of the intensity of intoxication and a possible prognostic indication. It also directs clinical attention toward the question of impaired elimination.

No survey of this subject would be complete without mention of an obvious fact, which is repeatedly referred to in the literature, and used indiscriminately by the proponents of conflicting points of view, each to support his own contention. This fact is that the presence of a toxin is not enough to prove its relationship to symptoms; that *absorption* is quite as essential as *elaboration* in the clinical production of intoxication. Thus Whipple (6, last reference) goes so far as to say that nothing produced within the lumen of the intestinal tract can be directly concerned in the intoxication of intestinal obstruction, because these substances cannot be taken up by the intact intestinal mucosa. Therefore he regards the toxic substances as formed in the mucous membrane under ob-

struction conditions, the part absorbed thence into the blood being the active source of symptoms and death, the part excreted into the lumen being inert so far as the host is concerned, but proof of the elaboration of toxin when injected into normal dogs. The workers at the University of Chicago, Cannon, Dagstedt and Dagstedt (7) believing that the essential toxins are formed in the lumen of obstructed bowel, state that the normal mucosa has a selective protective action against the absorption of such toxins, but that under obstruction conditions, especially with distention, circulatory disturbances, tissue necrosis, etc., absorption does take place with consequent intoxication. South and Hardt (10) working in the same laboratory, were forced to admit that distention and strangulation of the obstructed bowel were not always necessary factors for the development of toxic symptoms. Brooks, Schumacker, and Wattenberg, recognizing that production and absorption are the two elements necessary to intoxication, believe that necrosis and distention are important factors in absorption, though not necessary for the production of the toxin, which is formed in the lumen.

In appraising the evidence concerning absorption these cardinal points stand out. There is a toxin found in the lumen of obstructed bowel. This toxin when injected intravenously in normal animals causes the symptoms of intestinal obstruction. This toxin is apparently not absorbed when introduced into the normal unobstructed intestinal tract. Various explanations of what happens, when the bowel is obstructed, to cause absorption have been advanced, none of which is generally accepted.

The writer, availing himself of a privilege assumed by the rest advocating an explanation, suggests this: The toxins, found in obstruction cases and actually the cause of death when absorbed, if introduced into normal bowel *are* also absorbed. The first of this material absorbed produces the effect noted on injection experimentally, and similar to that recorded by Dr. Abel for histamine; namely, increased tone and peristalsis of the gastro-intestinal musculature. In the normal open gut, this hurries the bulk of the toxic material along and not enough is absorbed to cause serious symptoms. In the obstructed gut, vomiting and increased peristalsis result from the same cause, but the mass of the toxin is not thereby removed. Instead, stasis in the bowel, as in the experiments of Davis and myself, leads to the formation of more and more toxin, more and more of which is absorbed, until symptomatic and finally lethal effects result.

SUMMARY

The following facts concerning acute intestinal obstruction may be stated as generally believed:

1. The cause of death in acute obstruction is a form of chemical intoxication.

2. The toxic chemicals are developed in the process of protein disintegration.

3. The effect of these toxic chemicals is to cause a fall in blood-pressure, temperature disturbances, vomiting, diarrhœa, disturbance of kidney excretion, high non-protein blood nitrogen, delayed coagulation-time of the blood, profound congestion of the duodenal and jejunal mucosa, collapse, death.

The following points are in dispute:

1. The precise chemical nature of the chief toxic factors.

2. The precise cause, bacterial or other, of the protein disintegration that results in toxin production.

3. The precise mechanism of absorption.

The clinical surgeon may derive from all of this experimental investigation the following practical suggestions:

1. A confirmation and scientific reason for the previously generally held necessity of prompt relief of obstruction, and evacuation of the contents of obstructed bowel.

2. The use of the non-protein nitrogen content of the blood as a pre-operative guide to the degree of intoxication and a post-operative guide to prognosis.

3. The postoperative use of all measures that combat severe chemical poisoning, *i.e.* the induction of fluid into the system, the use of heat, the washing out of stomach and lower bowel, and enterostomy opening, if there be one.

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BENIGN GASTRIC ULCER IN A KNOWN SYPHILITIC

A RÉSUMÉ OF THE LITERATURE CONCERNING THE DIAGNOSIS OF ORGANIC GASTRIC SYPHILIS

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SEVERAL noteworthy papers have appeared regarding the various phases of gastric syphilis, but the writer has been unable to discover in the literature, any report of the occurrence of non-specific ulceration in the stomach of a syphilitic although Einhorn (1), Niles (2). Eusterman (3), Morgan (4), and others, have indicated the possibility of such occurrence. Einhorn, for example, reports a case of generalized syphilis with gastric carcinoma and states that syphilitics often suffer from other organic lesions of the stomach which are entirely independent of the co-existing general lues. Niles believes that ordinary ulceration of the stomach may occur in syphilitics with the same frequency as in those who are not infected. And Eusterman reminds us that a gastric lesion in the presence of a positive Wassermann reaction is not necessarily specific.

The history of the writer's case follows:

Mrs. C. P., age 26 years, first complained 8 years ago of nausea while eating with relief after vomiting. She had much gas in the stomach all the time. Pain across the upper abdomen, due, apparently, to the gas, came soon after eating if she did not vomit. Sour, bitter, burning eructations were frequent. Alkalis relieved the gas and the pain. This condition lasted all winter. After a long course of medical treatment she was free of gastric disturbance until 1917, one year after the birth of her baby. At this time there was no vomiting but much gas and distress in the stomach which were relieved by eating. She ate between meals and at night. In 1918, gastro-enterostomy and appendectomy were performed by F. T. Bascom for the relief of a pyloric ulcer and chronic appendicitis. In December, 1918, she reported to her physician, W. D. Wolff, with symptoms suggestive of secondary syphilis. The Wassermann reaction was 4+ and she was given a course of specific treatment. Following the gastrojejunostomy she was free from gastric distress for 7 months. Then the old malady returned with the addition of vomiting. Under a milk diet and bismuth for a period of 2 months she gained in weight and her stomach did not bother her much. A return to solid food, however, brought back the old trouble worse than ever. She had sharp pains at night straight across the upper abdomen when lying on the left side. Also, sudden sharp pain while walking on the street. She ate frequent small meals for temporary relief. Shortly before Christmas, 1919, she began vomiting nearly everything. Vomiting relieved the pain until the hungry feeling came on which forced her to eat and then she vomited again. In February, 1920, she entered the hospital for observation. The roentgenological examination was not informative. Pain precluded gastric analysis.

As the Wassermann reaction at this time was still 4+ she was given a course of intensive treatment by E. R. Sprague. Her gastric distress during specific medication became progressively worse until she vomited even water. One morning she ate a grape fruit and immediately had a feeling in her stomach like "hot water on an open sore." She entered the hospital at once. She had lost 33 pounds in 2 months. The Wassermann reaction remained persistently 4+. Examination at operation April 18, 1920, revealed a small stomach so distended as to require deflation. The pyloric ulcer for which the gastrojejunostomy had been done was apparently healed. A large calloused ulcer of the usual benign type was found on the posterior wall of the stomach adherent to the pancreas. The circular induration surrounding this new ulcer extended upward to the lesser curvature and downward to the artificial stoma. Elsewhere the gastric walls appeared normal.

The base of the ulcer was dissected from the pancreas. After separation of the anastamosis on the jejunal side, the line of union was found to be perfect and the opening uncontracted. The extent of the ulcer precluded simple excision. The pyloric half of the stomach together with some large lymph nodes in the gastrocolic omentum were, therefore, removed. The cut end of the duodenum was closed and the old opening in the jejunum was anastamosed to the gastric stump. Recovery was uncomplicated. Four weeks after operation the Wassermann reaction had become 1+.

Pathological report. The specimen consisted of the pyloric end of the stomach and glands and examination showed a gastric ulcer with fibrous base; chronic inflammatory changes; and lymphadenitis in mild degree.

Smithies (5) stated, in 1915, that syphilis of the stomach was not as uncommon as clinicians formerly believed since 25 cases had been reported in the United States during the past 6 years, whereas previously only about 70 authentic reports from all sources had been made. Smithies feels that this apparent increase in frequency is due largely to the general use of serological tests as a diagnostic aid in obscure intra-abdominal conditions. The 26 cases observed and reported by Smithies occurred in the examination of 7,545 patients affected with all types of dyspepsia.

Morgan quotes Ewald (6) to the effect that 10 per cent of all gastric ulcers are syphilitic, but Morgan is of the opinion that not more than 1 per cent of such lesions are specific. According to Eusterman it is doubtful if syphilis is an important etiological factor in simple gastric ulcer because (1) the two were associated in only one-third of 1 per cent in over 2,500 operatively demonstrated cases of benign gastric and duodenal ulcer; (2) Rosenow's (7) research in regard to the streptococcic origin of ulcers, and (3) lack of evidence that simple ulcer becomes gummatous in the presence of systemic or gastric syphilis. Castex and Mathis (8), on the other hand, hold the extreme view that inherited or acquired syphilis is the exclusive cause of gastric and duodenal ulcers. These observers interpret the periodicity of ulcer symptoms as being characteristic of tardy, inherited syphilis and the nocturnal exacerbation common to syphilitic lesions explains the "night pains" of ulcer. According to Morgan, however, the necropsy findings of Chiari and Stolper (9), in 329 pathologically demonstrated cases of lues were positive for syphilitic lesions of the stomach in only four instances. And Symmers (10) found only one such lesion during 4,480 necropsies.

The gross lesions of organic gastric syphilis are broadly classified by Eusterman into (1) gummata in various forms and (2) diffuse syphilitic infiltration. Eusterman considers as specific only those ulcers which result from the degeneration of a gumma. Smithies groups the pathological types of the malady into (1) diffuse infiltration in the areolar tissue causing thickening and stiffening of the gastric walls; (2) dense groupings of lymphocytes confined to the submucosa and mucosa which produce miliary gummata or coalesce, necrose, and slough to form ragged-edged ulcers, often multiple; (3) single or multiple inflammatory nodules, composed of exuberant connective tissue and lymphocytes which may involve the entire stomach wall producing extensive tumors (ulcerating or non-ulcerating), stenoses, and malformations in contour, and which may develop subperitoneally and peritoneally, resulting in (4) perigastritis with thickening of the stomach wall and dense perigastric adhesions.

Morgan describes the pathology of organic gastric syphilis most simply as originating usually in the form of a more or less circumscribed gummatous deposit or infiltration of the gastric wall. Occasionally such infiltration is diffuse. Later the gumma may break down and ulcerate. Still later the

cicatrization of the ulcer nay produce contraction and stenosis.

Eusterman notes the marked difference in the gross pathology between benign and gummatous ulcers as the latter are always multiple, occur usually at the cardia, the lesser curvature, and especially the pyloric portion of the stomach. There are usually associated perigastric adhesions, proliferative hyperplasia of the gastric walls, and other sequelæ resulting in gastric deformity. Eusterman summarizes the organic changes of gastric syphilis in the statement that a gummatous ulcer, usually multiple, and especially a diffuse syphilitic infiltration with variable degree of contracture (fibrous hyperplasia), thickening, deformity and perigastric adhesions chiefly involving the pyloric segment, is the most frequent pathological condition. Eusterman emphasizes the difficulty of differentiating such findings from those characterizing some types of scirrhus carcinoma, linitis plastica, or sclerotic inflammation secondary to benign ulcer, although the latter two forms are rare. The diagnosis may rest upon exploratory laparotomy or postmortem examination. All cases showed deformity, usually marked, with decrease in the size and contour of the stomach, due to cicatrizing gummatous ulcers or areas of proliferative infiltration in association with perigastric adhesions.

Downes and LeWald (11) describe the gastric lesions of syphilis as localized gummata, either single or multiple, occurring most frequently in the pars pylorica, involving either the lesser or greater curvatures, or both. These gummatous deposits starting in the submucosa and spreading gradually to the other coats undergo infiltration, ulceration, and cicatrization. One portion of the wall may remain infiltrated while another passes on to ulceration or may become cicatricial. Pyloric stenosis may result from the gummatous infiltration, cicatrization of the ulcer, or perigastric adhesions.

The microscopical evidence of organic gastric syphilis consists, according to Eusterman, of marked atrophy of the mucous membrane, hypertrophy of the submucosa, and a thickened muscularis due to dense connective tissue infiltration or fibrous hyperplasia. The blood vessels are invariably obliterated. This obliterative endarteritis and perithelial lymphocytic infiltration are most characteristic of syphilitic tissue. The spirochætæ were not found in the acquired cases.

In a case operated upon reported by McNeil (12) microscopical examination of the removed tissues showed degeneration, particularly of the submucosa and the muscular layers and somewhat marked periarteritis of all the arterioles. The mononuclear elements played almost the entire part in the periarteritis. At the point where attempted healing was suspected, new connective tissue was found. Sears (13) also reports a case operated upon in which the most characteristic thing found microscopically in the excised tissue was a very pronounced lymphocytic infiltration. Downes and LeWald observed in 2 cases the difficulty of microscopical differentiation between syphilitic infiltration and the tubercle.

In this connection Broders (14) reports a case presenting a clinical history suggestive of gastric ulcer or carcinoma with a positive Wassermann reaction. In the resected pyloric third of the stomach were three ragged ulcers. Microscopically, sections from these ulcers showed typical tubercles with characteristic giant cells. A few scattered tubercle bacilli were found in the depths of the ulcers. Some lymph nodes attached to the excised portion of the stomach showed typical tubercles and giant cells under the microscope. Sputum tests were negative. Necropsy revealed evidences of tuberculosis in the left lung without cavity formation. The signs and symptoms of gastric disturbance had completely dominated the clinical picture. Although the Wassermann reaction was positive, the gastric and pulmonary lesions were undoubtedly tubercular. Broders states that no case of tuberculosis of the stomach has been absolutely proven to be primary in the stomach.

Regarding the postmortem microscopical findings in organic gastric syphilis, Symmers noted in a stomach showing extensive ulcerative lesions, chronic productive inflammatory changes with miliary gummata, endarteritis obliterans and circumvascular plasma and round cell infiltration. Although Symmers

found also in this instance, syphilitic changes in the lymph nodes, nevertheless the failure to discover such corroborative evidence does not disprove the specific nature of the gastric lesion since McNeil reported, in an undoubted case of gastric syphilis, merely inflammatory changes in the lymph glands.

Relative to the stage of syphilis in which specific gastric lesions occur. Smithies observes that in 2 patients the stomach involvement appeared late in the secondary stage and in 22 cases the gastric affection was a tertiary manifestation. Eusterman states that of 16 cases the earliest symptoms appeared in 1 year and the latest 28 years after the disease was contracted. The average period was 11 years. Morgan believes that organic gastric syphilis is a tertiary manifestation of lues.

The symptomatology of organic gastric syphilis is varied. Eusterman states that the malady may simulate benign ulcer or carcinoma when in the pyloric region with stenosis and that multiple or extensive involvement with atypical symptomatology may defy diagnosis. "The symptomatology is variable because the pathology is variable. One of the most characteristic features is the absence of definite symptomatology." Morgan believes that there are no characteristic symptoms. Atypical chronic gastric disorders which resist the usual methods of treatment should arouse suspicion of syphilis. Einhorn says: "In making a diagnosis of carcinoma do not forget the possibility of gumma." Clark (15) considers the symptomatology of gastric syphilis so varied that specific treatment should be tried for all cases of stomach trouble before resorting to surgery. And White thinks that the possibility of syphilis should be considered in all cases of gastric and cardiac disease where the symptoms are not clear.

Smithies has classified the 26 cases observed by him into three groups according to the types of gastric histories as (1) instances of persistent gastric derangement in persons who had previously experienced no digestive upset; (2) instances in which a constant dyspepsia followed years of antecedent intermittent indigestion; and (3) instances of continuous gastric upset in those who had been affected gastrically in the past, but who had been for years free from digestive disturbances.

Of interest in this connection is the case reported by McNeil of a man who had suffered for 3 months with symptoms suggestive of benign gastric ulcer. Sharp epigastric pain came on from one-half to one hour after meals with aggravation from acids and considerable weight loss. There was no free hydrochloric acid and the total acidity was 25. The Noguchi test was positive. Rest in bed for 2 weeks under antisyphilitic treatment induced no amelioration of the pain. At operation a marked annular thickening encircling the first part of the pyloric region and enlargement of the pyloric lymph nodes was found. After resection of the pylorus an annular, apparently active ulcer almost completely encircling the first part of the pylorus was observed. The submucosa was most involved. The edges of the ulcer were undermined and soft. and the floor smooth. An attempt at healing appeared at one end. Microscopical examination showed degeneration, particularly of the submucosa and the muscular layers, and somewhat marked periarteritis of all the arterioles. The mononuclear elements played almost the entire part in the periarteritis. The lymph nodes showed simple hyperplasia. Morgan states that ulcer is the most frequent form in which gastric syphilis is recognized.

Niles reported a dissimilar case which presented the clinical and roentgenological picture of gastric carcinoma. There was an acidity, weight loss, cachexia. distress after eating, vomiting, regurgitation of gas, weight in the epigastrium, severe gastralgia, and X-ray distortion due to a new-growth. The Wassermann reaction. however, was 4+. A functional cure followed specific treatment. A relatively small number of cases of this type has been reported. There remains a large recognized group presenting, as explained by Eusterman, symptoms indefinite and variable because the pathology is variable.

The writer believes, therefore. that cases of organic gastric syphilis might well be symptomatically classified as (1) those simulating benign gastric ulcer, (2) those simulat-

ing gastric carcinoma, and (3) those presenting an atypical gastric history.

In a detailed consideration of the gastric syphilis syndrome in 23 cases Eusterman notes that the pain which accompanies the scirrhus or infiltrating types comes on immediately after eating and continues until the stomach is empty. Such patients eat small amounts of semi-solid or liquid foods frequently. The pain incident to the uncomplicated gummatous ulcer type, however, simulates that of benign ulcer, being remittent, rather periodic and coming on 1 to 3 hours after meals, but is only slightly or not all relieved by alkalis and food.

Downes (16) observes that, in general, the pain which is a most constant symptom lacks the periodicity of that occurring in the average simple ulcer and is not so much influenced by the taking of food. It is frequently worse at night. Clark also emphasizes the tendency toward nocturna exacerbation in organic gastric syphilis. And Morgan believes that the pains of this malady are always worse toward night. Eusterman, on the other hand, in a series of 23 cases, noted definite nocturnal pain in only 3 instances. Although nausea is unusual Downes and LeWald marked vomiting in all of their 8 cases, and Eusterman observed it in 85 per cent of his series. Rapid, marked weight loss without commensurate cachexia or decrease of strength is frequent. The appetite remains good. Clark noted a tendency toward severe hæmatemesis after a latent course in several instances, and Einhorn reports a case of syphilitic ulcer with profuse gastric hæmorrhage. Eusterman, however, states that hæmatemesis is rare. Smithies mentions its occurrence only once in a series of 26 cases and Downes believes that hæmorrhage is less frequent than in peptic or duodenal ulcer. Observers generally consider anacidity a striking characteristic of organic gastric syphilis. Smithies, however, states that the free hydrophloric acid may be normal or only slightly reduced.

Regarding the palpability of specific gastric tumors Einhorn reports three personal cases in which masses were felt through the abdominal walls. Morgan has palpated a movable pyloric tumor in 2 cases and Downes and LeWald felt a hard, indefinite epigastric mass in one instance. Eusterman palpated a tumor in only one case in a series of 23. Eusterman noted, in several other instances, epigastric masses simulating gastric tumors which disappeared under specific treatment, but these were not clinically and roentgenologically proven to be of gastric origin. Eusterman, therefore, concludes with Hausmann (17) that such masses might be syphilitic lesions of the liver. Morgan believes that the muscle resistance and tenderness elicited by abdominal examination, noted also by Eusterman and others, explains the failure to feel specific gastric tumors more frequently.

The roentgen-ray findings in syphilis of the stomach, according to Downes and LeWald, may be divided into three classes: First, a rather typical, diminished size, and dumb-bell-like appearance of the stomach due to deformity caused by infiltration involving the middle or pyloric half of the stomach. The pylorus may be involved and held open so that the stomach empties or begins to empty rapidly as in carcinomatous infiltration. Even though the stomach begins to empty rapidly a trace of food may remain high up at the cardiac end at the sixth hour.

The second type resembles the first but the pyloric involvement or the stenosis of the infiltrated portion of the body of the stomach may cause delayed emptying as occurs in ulcer or carcinoma. In both types the stomach seems smaller than normal with a tendency toward compensatory dilatation of the œsophagus.

In the third type the infiltration may involve only the pyloric region with findings resembling those of cicatrized ulcer and may be accompanied by dilatation of the stomach. Smithies reminds us that the roentgen demonstration of such gastric deformities is not pathognomonic of syphilis since similar abnormalities might be observed in benign or malignant peptic ulcer and carcinoma. Carman (18) also states that "syphilitic hourglass may result either from luetic ulceration or hyperplasia. The hyperplastic or gummatous type with filling defects and a corresponding palpable mass is not roentgenolog-

ically distinguishable from cancer. Syphilitic ulcers are often multiple with a strong tendency to the production of hour-glass. However, the roentgenologist first suspects syphilis rather than cancer from certain clinical facts and not from the roentgen picture. There is no palpable mass, the patient may be under the cancer age, he is anæmic rather than cachectic, and has not lost weight and strength in proportion to the extent of the gastric involvement and the duration of his trouble. Then with a positive Wassermann, the diagnosis of lues is warranted, but hardly otherwise."

In spite of the manifest difficulties, Eusterman believes that the diagnosis of organic gastric syphilis usually may and should be made, when occasion requires, without postmortem examination or the microscopical examination of resected tissue. In this opinion Smithies concurs with the statement that the general use of serologic tests as a guide in the differential diagnosis of unusual intra-abdominal complaints is largely responsible for the increasing frequency of recognition of this malady. Eusterman observes that the diagnosis is based usually upon a past history of initial and secondary symptoms, on the demonstration of late syphilitic manifestations, Wassermann-Noguchi reactions, and the results of specific therapy.

The Wassermann test is most helpful in differentiating gastric syphilis from simple ulcers and other diseases of the stomach, particularly carcinoma. However, the absence of a syphilitic history and a negative Wassermann reaction does not exclude the possibility of syphilis. Also a gastric lesion in the presence of a positive Wassermann reaction is not necessarily specific. We must, therefore, exclude cases presenting a fairly regular syndrome, with normal or increased acid values, if the gross appearance at operation or the microscopic picture of resected tissue is that of the usual chronic calloused gastric ulcer, or when improvement in gastric function is notable without antisyphilitic treatment. The symptomatology of organic gastric syphilis usually suggests benign ulcer, but the gastric chemistry and the X-ray suggest carcinoma.

Downes observes that the diagnosis of organic gastric syphilis hinges upon the clinical and laboratory findings. In the congenital cases, the family and previous history of the patient, his general development and appearance, with the symptoms of chronic stomach trouble should be suspicious. In the acquired cases the past history plus unusual symptoms should suggest something out of the ordinary. In both types the disease differs from the simple gastric or duodenal ulcer, as it is influenced but little by dieting and the usual treatment, and it is unlike malignancy since there is not the steady, continuous progress to a fatal termination. "A positive Wassermann reaction with roentgenographic findings, of persistent and unusual deformity of the stomach, establish the diagnosis beyond much doubt. The value of antisyphilitic treatment in confirming the diagnosis of syphilis in general cannot be ignored."

Clark states that gastric disturbances which are characterized by chronicity, night exacerbations, anacidity, and gastric achylia, especially if accompanied by a positive Wassermann reaction, are presumably syphilitic. In view of the absence of characteristic symptomatology in organic gastric syphilis, Morgan considers the diagnostic criteria to be the Wassermann reaction and the therapeutic test.

The diagnostic value of such test is generally conceded. For example, a case reported by Einhorn of gastric tumor with a negative Wassermann reaction, which simulated carcinoma even at exploration, was later symptomatically cured by specific medication. And Morgan observed, in several instances, the amelioration of symptoms and the disappearance of gastric tumors which could not be differentiated from carcinoma, under antisyphilitic treatment. Smithies reminds us, however, that too great reliance should not be placed upon the effects of antiluetic medicines since they sometimes favorably influence non-specific conditions. Downes, on the other hand, defends the therapeutic test with the statement that the improvement following its administration is transient in non-specific stomach lesions, whereas in gastric lues, there

is almost immediate and continued relief from symptoms. But it is not an infallible guide since McNeil reported a case which symptomatically resembled benign ulcer although there was no free hydrochloric acid and the Noguchi reaction was positive. A course of specific medication during 2 weeks failed to afford relief. Nevertheless, the tissues removed at operation were definitely syphilitic.

The confirmation of the diagnosis by operative findings is relatively infrequent because, as Smithies reminds us, the treatment of gastric syphilis is essentially medical and, therefore, the diagnosis usually rests upon non-surgical evidence. Nevertheless, on occasion, laparatomy has been done unsuspectingly and the diagnosis made from observation of the gross pathology. Smithies further states that even at operation the diagnosis is often in doubt and that gastro-enterostomy has been performed for the relief of syphilitic gastric ulcer. "Experienced surgeons, however, leave undisturbed the well-delimited, hard, plaque-like ulcers and the firm nodular tumors which arise from a stomach wall already thickened by diffuse, infiltrating, exuberant connective tissue." Einhorn reports a case in which the abdomen was opened with a pre-operative diagnosis of carcinoma of the pylorus, the Wassermann reaction being negative, and a large, irremovable tumor, presumably carcinoma, discovered. Later, specific treatment was tentatively administered with symptomatic relief and disappearance of the tumor.

McNeil and Sears each report a case in which the radically removed tissues were definitely proven to be syphilitic by microscopical examination. McNeil's patient obtained no relief from antileutic medication prior to operation. Downes and LeWald, on the other hand, report a series of 8 cases in which the diagnosis of gastric syphilis had been quite definitely established by clinical, serological, and X-ray examination, but in 2 of the 5 cases which were operated upon, microscopical examination was not conclusive. In one a suspicious nodule from the liver and in the other, a section of the gastric wall, the tissues could not be differentiated from tubercular tissue although the microscopical appearance of the gastric mucosa and submucosa in the latter was rather suggestive of syphilis.

The postmortem evidence of gastric syphilis is meager. Chiari and Stolper discovered only four instances during the examination of 329 syphilitics. And Symmers, in 4,880 necropsies, 314 upon known syphilitics, found but 1 gastric ulcer of indubitable syphilitic origin. There were also characteristic gummatous changes in the liver and lymph nodes and syphilitic aortitis. The extensive ulcerative lesions in the stomach presented chronic productive inflammatory changes with miliary gummata, endarteritis obliterans and circumvascular plasma and round cell infiltration. Symmers, therefore, is not inclined to accept the diagnosis of gastric syphilis unless it is confirmed by microscopical evidence. White (19) observes, in this connection, that the infrequent discovery of gastric lesions after death has led postmortem observers to look askance at the diagnosis of gastric lues, yet the same condition obtained in lesser degree in benign ulcer since the lesion was found most often, at first, by the surgeon.

SUMMARY

Organic gastric syphilis is more frequent than formerly supposed. The gross lesions of gastric syphilis are (1) gummata in various forms, and (2) diffuse infiltration. Specific ulcers result from the degeneration of gummata. Symptomatically such lesions differ from benign ulcers chiefly in the absence of pain ease from food and alkalis, less periodicity, anacidity, vomiting with good appetite, excessive weight loss and improvement in gastric function with specific treatment. Without operation the diagnosis usually rests upon a past history of early syphilis, present late syphilitic signs, Wassermann reactions and the therapeutic test. However, a negative Wassermann reaction does not exclude the possibility of gastric syphilis, and benign lesions of the stomach may occur in a known syphilitic. At operation specific ulcers are always multiple, ragged lesions occurring usually at the cardia, the lesser curvature, or the pyloric region accompanied often by perigastric ad-

hesions, thickened gastric walls, and gastric deformity. Large gummatous tumor masses or cicatricial contractions subsequent to extensive ulceration simulate carcinoma, particularly as regards the type of dyspepsia, the vomiting, the rapid weight loss, and the anacidity, although the cachexia and loss of strength are less than that encountered in malignancy and the course may have been longer. The operative findings consist, usually, of an irremovable gastric tumor mass indistinguishable from carcinoma. The X-ray evidence also simulates carcinoma. The roentgenographic signs of organic gastric syphilis in general consist of encroachments upon the lumen, distortions, and deformities. The microscopical evidence consists of the characteristic syphilitic obliterat've endarteritis and perithelial lymphocytic infiltration with atrophy of the mucous membrane and hypertrophy of the submucosa and the muscularis. Postmortem confirmation of the diagnosis is infrequent.

CONCLUSIONS

1. Organic gastric syphilis may simulate (a) benign gastric ulcer, (b) gastric carcinoma, or (c) present an atypical gastric picture.

2. The diagnosis of organic gastric syphilis is often difficult and sometimes impossible.

3. A negative Wassermann reaction does not disprove the existence of syphilis and a positive reaction does not prove that a gastric lesion is specific.

4. The "therapeut'c test" is usually reliable but not infallible.

5. The roentgenographic evidence is not conclusive.

6. Exploration may not be determinative, particularly as regards differentiation from carcinoma.

7. Atypical, chronic gastric disorders which are unresponsive to the usual treatment should arouse suspicions of syphilis.

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THE DIAGNOSIS AND TREATMENT OF CHORIO-EPITHELIOMA[1]

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ONE of the most unique tumors in the category of malignant neoplasms is the chorio-epithelioma of Marchand. It represents a truly parasitic growth in so far as it originates from cells foreign to its host and then maintains an independent existence, drawing its nutrition from the tissues in which it is embedded.

I believe at this period all clinicians and histologists will agree that the chorionic epithelium is the origin of the malignant chorio-epithelioma. We find this tumor either intra-uterine or extra-uterine in situation, that it may follow a pregnancy, either normal or pathological, and that the pregnancy is sometimes recent, at other times long past. The period of latency has been reported as long as 9 years. The occurrence of the tumor following labor, miscarriage, or an abnormal pregnancy, such as hydatidiform mole, has been well and often described. Its situation intra-uterine or extra-uterine, either associated or independent, has been thoroughly considered and from the purely clinical point of view there is very little to be added.

The clinical aspect has been accurately described, and while exact in portraying its symptomatology, does not aid in giving a definite prognosis. There are times when the help of the pathologist is asked; often he cannot determine whether a certain tumor will or will not respond to one or another form of treatment or even if the histological picture warrants a definite diagnosis.

The original division of malignant chorio-epitheliomata into two groups, (a) typical and (b) atypical, though seemingly arbitrary, has been well maintained ever since its inception by Marchand. In the class designated typical there is histologically a distinct picture. One finds multinuclear syncytial masses and also groups and plaques of mononuclear Langhans cells showing mitoses and variations in size, shape, and state of degeneration. The extent of participation of both components varies markedly so that one or other elements may predominate, with all the possible graduations. The growth while exceedingly vascular shows a marked tendency to disintegration and necrosis. This type is considered the malignant form.

The second group, the atypical, shows invasion of the musculature of the uterus by syncytial masses or isolated cells and is characterized by the absence of Langhans cells.

Metastases are more commonly associated with the typical chorio-epithelioma and may take place not only in the pelvis and vagina but in all the organs of the body, especially in the lungs. These metastases occur through the blood stream. One of the characteristics of the tumor is its tendency to erode blood vessels and to grow into their lumen. This avidity for the blood vessels makes the problem of metastasizing a simple one to understand (Fig. 1).

On the other hand while the atypical group gives rise to metastases, it is comparatively uncommon and rarely if ever so widespread.

Between these extremes there are many intermediate stages. Histologically we find cases with steadily decreasing numbers of Langhans cells until we arrive at the group where the syncytium predominates and then finally to the above described atypical group with persistence only of the syncytial elements. Villi are found both in the typical and transitional cases and even in the purely syncytial type occasionally villi are encountered (Fig. 2). Their prognostic value is open to question but Ewing believes that their presence has some bearing on the clinical course. In a rather exhaustive article Ewing has attempted histologically and prognostically to classify these tumors according to a more or less definite microscopical picture. In fact he believes that the histological structure of the chorionic tumors and the clinical course can be correlated and that prognostic value may be attached to the microscopical ap-

[1] Work done under tenure of a George Blumenthal, Jr., Fellowship in Pathology.

pearance of the tumor. He groups his types, according to their histological characteristics, under the following names: Chorio-adenoma destruens, choriocarcinoma, syncytial endometritis, and syncytioma.

EWING'S CLASSIFICATION

He reserves the term chorio-adenoma destruens for a type of tumor composed of elongated, hypertrophied villi clothed with actively proliferating cells of both syncytial and Langhans type. Such villi infiltrate the uterine sinuses and enlarge the uterus forming often a polypoid tumor. This tumor tends to remain in the uterine cavity but in many instances extensions occur in the broad ligament and pelvic veins with metastases in the vagina and lungs. The metastases often contain villi. The tumor rarely forms general metastases but produces all the structures of the normal villus in an orderly fashion.

The presence of villi is a reliable ground for classification but more important is the presence of orderly branching buds of vacuolated syncytium and sharply defined Langhans cells of normal type. This destructive polyp offers a hopeful prognosis which Ewing believes differentiates it from the malignant type.

This group he believes is a genuine neoplastic process but more benign in its clinical course than the growths termed choriocarcinoma. (It may be cured by curettage, partial removal, or may even spontaneously regress or be expelled.) He urges a more conservative treatment for this group of cases, such as curettage and only in cases of alarming hæmorrhage with enlargement of the uterus does he advise hysterectomy.

The commonest type of neoplasm arising from the chorion, the typical chorio-epithelioma of Marchand he designates choriocarcinoma. In these cases the chief feature is the absence of villi, very extensive proliferations, and pronounced metaplasia of Langhans cells and syncytium (Fig. 3). They grow diffusely and do not show the orderly arrangement of the milder forms of chorionic tumor. The tumor in the uterus is small, the uterus slightly enlarged, but there may be numerous metastases. In some cases there is an absence of a primary uterine tumor (Fig. 4). In this group the prognosis is bad, the great majority of these cases prove fatal in spite of early operations. In cases of this type with metastases, the prognosis is always fatal.

In reference to this group we feel that too pessimistic a prognosis is made, as we have had several of this type with recovery following operation. In addition we have found cases of typical choriocarcinoma with a few well preserved villi (Fig. 5). These villi we interpret not as a part of the choriocarcinoma *per se* but as the remains of the pre-existing pregnancy that gave rise to the tumor.

A third type coinciding with the atypical chorio-epithelioma of Marchand is called by Ewing syncytial endometritis. In this process the syncytial invasion of the muscularis of the uterus constitutes the whole process. The uterus is diffusely enlarged due to the invasion of the uterine wall and sinuses with large mononuclear or giant syncytial cells. The growth may appear as a more intense variety of the normal infiltration present in pregnancy. The tumor may arise from a large area of the internal surface of the uterus or involve only a relatively small area. It may present itself as one large mass or surround the cavity as irregular globular masses. The tumor itself is composed mostly of blood, fibrin, necrotic tissue, and groups and masses of syncytial cells. In some instances these cells may constitute the most prominent feature of the growth and to this variety the term syncytial chorioma is given. Occasionally metastases in the broad ligament or vagina may arise but they are really deported, regressive villi or syncytium, and not genuine progressive metastases. The prognosis is favorable, and curettage, when the diagnosis is definite, is sufficient.

AUTHOR'S CASES

Choriocarcinoma		
Died—sepsis	1	
Hæmorrhage	1	
Without operation, admitted moribund	1	
Recovered	6	9
Curettings, typical choriocarcinoma	1	
Syncytiomata	2	
Syncytial hypertrophies	2	5
Total		14

I have had the opportunity of studying 14 cases with a view to classifying, as did Ewing, the chorio-epithelioma in accordance with a definite histological picture, and to determine the value of the pre-operative diagnostic aid of the microscope.

Nine cases of the 14 could be classified as choriocarcinoma; of these 3 died. Of the 3 that died 1 developed a sepsis following a curettage and packing, 1 an ectopic choriocarcinoma died on the operating table from hæmorrhage, while the third was admitted moribund with generalized metastases and died without operation. The other 6 recovered. Of the remaining 5 cases, 1 presented curettings that were typical of choriocarcinoma but recovered with no other operative interference. Two cases were typical syncytiomata, and 2 were atypical and are classified as syncytial hypertrophy.

Many of the cases had preliminary curettages for bleeding and this material was studied to determine if an absolute diagnosis could be made. If the diagnosis was determined could we definitely set an operative indication?

Of the 14 cases studied there were 11 in which a previous curettage had been done. In 6 instances the curettage had been performed from 2 weeks to 1 month previously for varying symptoms (mainly bleeding). In three instances there was a report of hydatid mole, in two, fœtus and placenta was the diagnosis, and in one, done at another institution, the curettings were reported miscarriage. Of the 3 instances of mole a further study of the curettings with the knowledge obtained postoperatively would have permitted a diagnosis suggesting chorio-epithelioma (Fig. 6). In other words, in these six instances the diagnosis was not made from the curettings, though in 3 it would have been reasonable to suggest the possibility.

In 4 other instances a curettage preceded the hysterectomy by just a few days, because of a history of bleeding. In 3 of these cases an absolute diagnosis was made from the curettings, and on one, where a section of uterine muscle was removed, histological study showed only an invasion by syncytium. This uterus nevertheless was removed because of persistent bleeding but showed no other abnormality. In other words, in 4 suspicious cases a positive diagnosis was made in 3, while the fourth case which did not present a typical picture proved later to be a type classified by Ewing as syncytial endometritis, a group I would rather consider to be a simple exaggeration of the normal condition in pregnancy or a perverted activity of the fœtal cells and not a true tumor. This type will be considered more fully later. Of the three cases diagnosed as chorio-epithelioma, a subsequent hysterectomy proved the correctness of the opinion, each uterus containing a typical chorio-epithelioma of Marchand. The other instance of curettage was a case that gave a typical history, the curettings were diagnosed chorio-epithelioma, but the patient left the hospital against advice and was not heard from again. The diagnosis, therefore, was not confirmed by examination of the specimen.

From the histological appearances of the material which was curetted many difficulties presented themselves when it was attempted to make a definite diagnosis as to malignancy and to indicate a prognosis or determine an operative procedure. A uterus may harbor a malignant tumor of this type and yet the curettings reveal nothing definite. One may not encounter the tumor or may remove only small fragments of necrotic tissue that are not characteristic. On the other hand one may get definitely characteristic tissue which will lead to the diagnosis. From the curetted material of a case whose clinical history is at all suspicious a positive diagnosis can be made if one finds masses of syncytial cells and plaques of Langhans cells showing marked variations in size, shape, and chromatin content. Other histological signs of activity such as an increased number of mitoses in these Langhans cells will help confirm the opinion. In addition other facts can be found to substantiate the diagnosis. The arrangement of the syncytium and Langhans plaques shows no orderly or definite grouping, there is no relationship to chorionic villi, there is often marked hæmorrhagic infiltration, thrombi, large blood sinuses, and leucocytic invasion of the necrotic tissue which is present. Such a picture leaves but little

doubt as to the diagnosis and if in addition a small fragment of myometrium has been obtained and shows marked invasion by both cell types such confirmation allows no other opinion but chorio-epithelioma.

Unfortunately all the material submitted is not so definitely characteristic. We may get curettings that show the typical villi of a hydatid mole and a moderate proliferation of one or even both cell layers (Fig. 7). Here there is very little to base a diagnosis on and in such instances the advice of the pathologist must be to wait. If the proliferation of the cell layers is marked, mitosis active, and cell variation extreme, here again it would be advisable to operate radically rather than risk the possibility of overlooking the malignancy.

The difficulties in setting indications are numerous and there are unquestioned instances where cases have recovered without hysterectomy in which the pathologist would have been compelled to make a positive diagnosis of malignancy. On the other hand there are instances where an apparently harmless mole after a lapse of a few months or sometimes longer has reappeared as a malignant tumor. In one instance in our series a curettage diagnosed hydatid returned 2 years later with a typical chorio-epithelioma (Fig. 8). On studying the early curettings more carefully several suspicious areas were found but hardly enough to justify the diagnosis at that time. On the other hand several hydatid moles with quite similar pictures have made perfect recoveries, and remained well after periods of from 2 months to 6 years (Fig. 9).

It is just in the borderline case that the decision for the surgeon is so important and the diagnosis for the pathologist so difficult. The curettings may show no variations from the normal findings in a postpartum or postabortive case. Occasionally we have mucosa or tissue presenting only a marked increase in the syncytial cells with penetration into the muscularis (if one is fortunate enough to get a fragment of musculature in the curettings). In such an instance we are confronted with a normal picture after pregnancy, for such conditions occur frequently. In fact Hitschmann has described such appearances following labor where there is an absence of decidua and a marked infiltration of the musculature with syncytial cells often giving rise to an adherent placenta but not to a new-growth. Again we may be dealing with tissue derived from the edge of a true chorio-epithelioma, and have no other characteristic tissue from which to make the diagnosis. On the other hand the tumor may be an atypical chorio-epithelioma the course of which is often benign but in some rare instances may be malignant.

SYNCYTIAL HYPERPLASIA

This is the group of cases that Ewing has termed syncytial endometritis, and their course is extremely interesting. A study of the literature has demonstrated that this type of cases runs in almost all instances a benign course and in view of this it would seem that such individuals can safely be watched after the initial curettage and only for subsequent clinical indications as profuse hæmorrhage or infection need be operated upon.

As to the classification of their type, I do not believe that the term syncytial endometritis is a good one as the condition is not an inflammatory one and not an endometrial involvement. The inflammatory reaction that is found associated with this condition is also found in cases of true chorio-epithelioma or other intra-uterine tumors. The invasion of the uterine wall is much more extensive than that of the endometrium and the cells that characterize the tumor have no relationship to the mucosa of the uterus. As to the terminology, if one regards it as a new-growth, the original term of Marchand, atypical chorio-epithelioma, is well adapted. But is it truly a new-growth? Is it not rather an exaggeration of a normal reaction to pregnancy? These cases may form localized tumefactions but they do not truly run the clinical course of a malignant neoplasm. They do not form metastases and the lesion itself is seldom progressive as is a real new-growth, but on the contrary is benign and retrogressive in its course.

Careful consideration of the process leads us to believe that it is really not a neoplasm in the true sense of the word. Thus, if one makes the diagnosis of the condition, in view

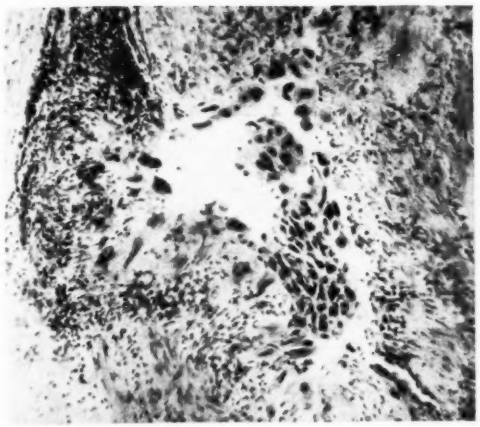

Fig. 1. Vessel filled by tumor cells and showing cells breaking through walls. Illustrates the mechanism of metastases.

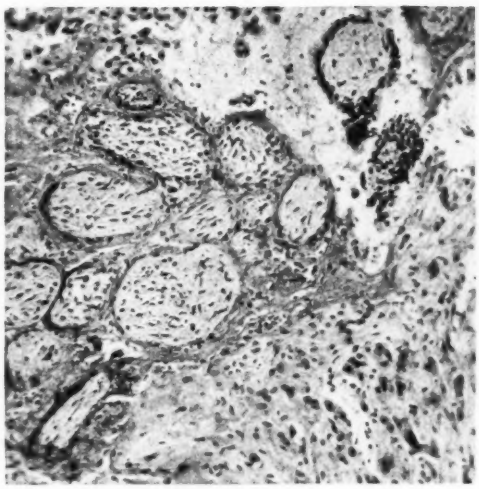

Fig. 2. Intact villi in midst of syncytial tissue invading uterine musculature.

of the benignancy in properly treated cases, it is wiser to advise waiting before any drastic steps are taken. It is from this type of case that so many reports of cures of chorio-epithelioma after curettage have been obtained, and this should be the only treatment except when complicating hæmorrhage or infection clearly indicate other procedures. Often the clinical course, especially a recurrent profuse hæmorrhage after a diagnosis of this type, will throw doubt on the accuracy of the pathological diagnosis. In such instances it would be unwise to delay operation, for even should the extirpated uterus show no true typical chorio-epithelioma, it is better to sacrifice a uterus than jeopardize a life. The designation for this condition is difficult to give, the process is not a true tumor, nor an inflammation. It represents really an exaggeration of a normal process and it would seem that a name not implying either new-growth or inflammation would be more accurate. Such a term as syncytial hyperplasia, to my mind, would be more accurate (Fig. 10). This would not apply to the group termed by Ewing, syncytioma, where a definite tumor of a definite type of cells exists.

SYNCYTIOMA

Syncytioma exists as a definite tumor and is made up of groups and islands of syncytial cells, often giant-cell in type, forming the smaller part of the tumor, the greater part being made up of blood clot, degenerating and necrotic tissue, fibrin and leucocytes, the function of which is phagocytic. As mentioned above, this process is regressive in character and the dangers from its existence are hæmorrhage due to the erosive process of the viable syncytium and its accompanying symptoms of anæmia, or infection due to curettage, which may lead to peritonitis or general systemic invasion.

This class of chorio-epithelioma is a real neoplasm and Ewing's nomenclature in this instance I believe is quite accurate and descriptive. This group represents a transition from the syncytial hyperplasia on the one hand to the advanced typical chorio-epithelioma or choriocarcinoma of Ewing on the other. It is the first real step in the nature of a true neoplasm. Ewing views it more as a regressive type of the choriocarcinoma, but it seems to me that this type of tumor composed of masses and groups of syncytium really represents a definite type of new-growth. It is not simply a regressive and degenerating chorio-epithelioma in which all the Langhans elements have disapprared, but a growth composed of one definite cell type. Its

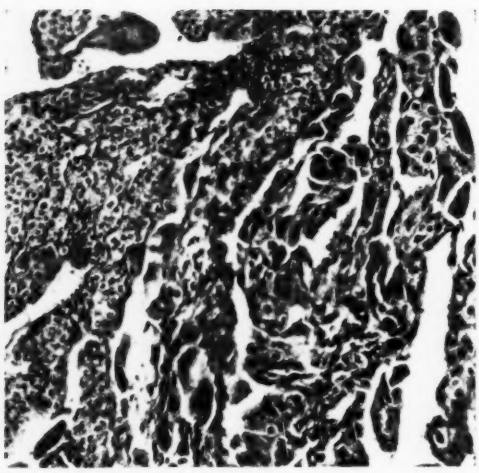

Fig. 3. Typical choriocarcinoma. Intra-uterine tumor following normal pregnancy. Both types of cells clearly shown.

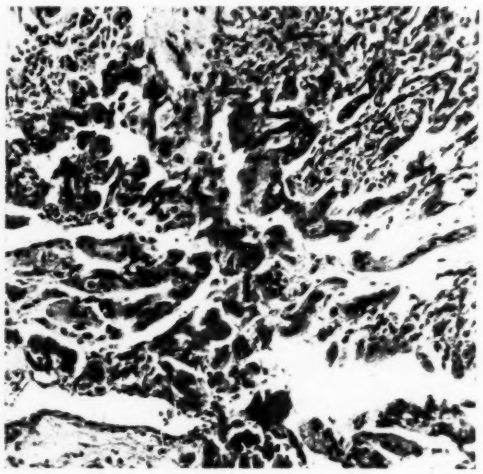

Fig. 4. Ectopic choriocarcinoma. No lesion in the uterus. Tumor localized to right pelvic wall and involving iliac vessels. Both types of cells in tumor.

histology resembles that of the syncytial hyperplasia except that the process itself is a definite tumor or group of tumors situated on and extending into the uterine wall (Fig. 11). Chorionic villi are often seen but I do not believe these to be part of the tumor *per se* but simply included groups of villi derived from the placental tissue that antedated the tumor. To my mind, they represent the starting point for this tumor. Its course is very much like that of the benign syncytial hyperplasia, and while it may cause clinical symptoms due to the penetrating and erosive qualities of the syncytium it is not essentially malignant. In this group of cases, as in the syncytial hyperplasia, if an absolute diagnosis can be made, one should wait for clinical symptoms, but if a doubt exists, he should operate. In two instances where curettings were examined, a diagnosis of "tissue suggesting chorio-epithelioma" was made. On the basis of this report hysterectomy was performed and while no true chorio-epithelioma was found, a tumor composed of groups and masses of syncytium situated on, and invading the muscularis surrounding and penetrating the vessels, was present, and we felt warranted in operating. It is true that this type of growth is rarely malignant and that many of the reported cures after curettage or incomplete operation deal with this class of cases, still, in view of the difficulty of absolutely diagnosticating the type of growth, it is better to err on the safe side and remove what may prove to be a life threatening process.

Metastases rarely take place and if they do they do not continue an independent existence but represent merely a mechanical embolic process. These cells may for a time persist but eventually become regressive and disappear.

CHORIOCARCINOMA

In Ewing's classification a group of cases is separated out and called chorio-adenoma. While such a nomenclature would be valuable it seems that many difficulties present themselves that make such a subdivision impractical. At what point in the tumor process shall one cease to say syncytioma and term the group chorio-adenoma? At the first appearance of Langhans cells? And wherein do chorio-adenoma and chorio-epithelioma really vary? The group is one of the transitional stages between the benign syncytioma and the malignant chorio-epithelioma and is better classed with the choriocarcinoma.

At times one may find a tumor that presents histologically a picture resembling

Fig. 5. Typical choriocarcinoma showing well preserved villi. See Figure 9.

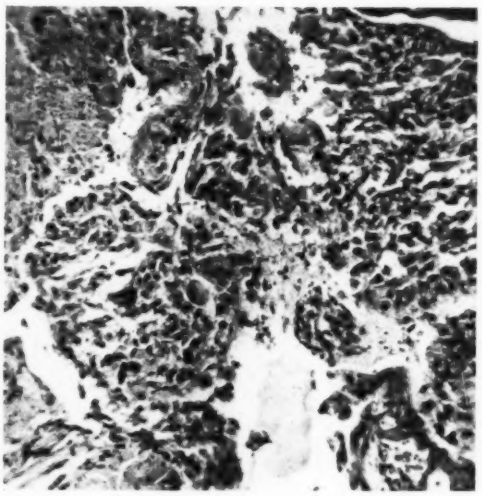

Fig. 6. Curettings showing marked proliferation of both cell types. Returned 2 years later with typical choriocarcinoma.

choriocarcinoma but with less marked cellular variations, few Langhans cells, and the presence of villi, well preserved. While this picture coincides with the group that Ewing terms chorio-adenoma it often presents areas that are indistinguishable from the true choriocarcinoma. The main argument advanced for the subdivision is the fact that these cases run a more benign course, but here again while it may be that in many instances a favorable prognosis can be attempted from a histological picture, one is often mistaken. Even the cases of truly malignant choriocarcinoma, when associated with metastases may regress after an incomplete operation, or even after none. We feel that there is nothing characteristic about the histological picture found in choriocarcinoma or its transition that would warrant a definite prognostic value until the group of syncytioma is reached. Here we feel one may prognosticate a favorable outcome with reservations and careful observations, dealing more with the clinical aspects of the condition than the histological.

The two classes just described offer great difficulties in their diagnosis from the examination of curetted or expelled material. If it is possible in these cases, in which at the time of operation the diagnosis is in question, to introduce a finger into the uterus either through the dilated cervix or through an approach operatively made (a vaginal hysterotomy), this procedure might be of great assistance, as in the malignant cases an excavation or tumor (Vineberg) can often be felt, or from a suspicious area more material may be obtained. The diagnosis of the more malignant type when clear-cut determines the prognosis and operative indications definitely. However, it is found that curettings which warrant a diagnosis of the more malignant type may be obtained from cases that, with no subsequent operative interference, do perfectly well and recover completely. Transitional types further add to the difficulties of definite classification, for there is marked overlapping of groups, and it is impossible to say when one group ends and another begins. One may have a syncytioma, then here and there a few areas suggesting true choriocarcinoma and a gradual increase in the malignant process until the picture is that of a typical choriocarcinoma. While such transitional cases may regress or may be cured by minor local interference, we feel they must be viewed as malignant and necessitate a

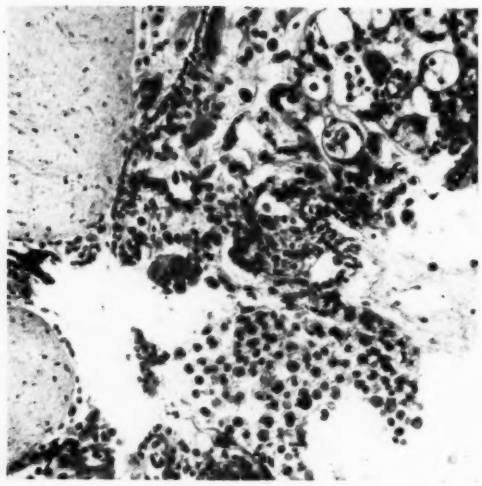

Fig. 7. Curettings showing hydatid mole with areas of Langhans and syncytial proliferation. Returned subsequently with typical choriocarcinoma in 2 months.

hysterectomy. The spontaneous regression or cures after minor operations usually occur in the cases showing few Langhans cells, or, in other words, in the group most clearly associated with the true syncytioma.

The typical chorio-epithelioma is the fully developed malignant type. Its histology is distinct and has been accurately described. Ewing reserves for this group the term choriocarcinoma, a name we feel well adapted to describe the origin and to carry the implication of its malignancy. The clinical course of this type may vary markedly from a most rapidly growing and metastasizing tumor to one that may spontaneously regress after curettage or spontaneous expulsion of tumor masses even after metastases have developed. One of the striking characteristics of this entire group of tumors, syncytioma, transitional chorio-epithelioma, and the typical choriocarcinoma is the regressive tendency so often exhibited both by the primary growth as well as its metastases, with, or even without operative removal, complete or incomplete, of the primary focus.

Of the cases under our observation all but two had a hysterectomy. Three died, one an ectopic choriocarcinoma which showed no uterine tumor but a typical growth involving the pelvic wall and broad ligament. This case died of hæmorrhage while on the operating table. The second case was one not operated upon. At autopsy this case showed a large typical tumor of the uterus and multiple metastases in practically all the viscera and skin. The metastases showed the typical structure of the primary tumor with plaques of Langhans cells and groups and masses of well preserved syncytium. The third case was one that after a curettage and packing developed a sepsis. A hysterectomy done shortly after the curettage showed a typical tumor but the patient succumbed to the general infection. (Reported by Dr. Vineberg.)

One case after a curettage, in which the diagnosis of chorio-epithelioma was made, had no subsequent operation but nevertheless made a perfect recovery. In spite of this favorable result and notwithstanding the reports of similar cases in the literature when the histological picture of material examined is that of the typical choriocarcinoma, hysterectomy, even if signs of metastases are present, is the absolute indication.

In such cases an abdominal hysterectomy and not a vaginal one should be done, for it has been shown by Hitschmann and Cristofolletti that the trauma incident to a vaginal hysterectomy often causes widespread metastases and may then influence a fatal outcome. They have also shown that cases not operated upon metastasize late while cases operated upon even after a curettage may metastasize very early and intensively. They believe that the mechanical handling of the uterus causes the emboli, and they urge the tying of the veins before the uterus is manipulated at all. They set the limit of operability by the possibility of operative removal of the primary growth irrespective of the number and distribution of metastases, as these have been known to undergo necrosis and absorption after operative removal of the primary tumor.

Schlagenhaufer, Marchand, Aschoff, Hitschmann, and Cristofolletti advocate the position that histologically there is no evidence sufficiently definite to warrant absolute prognostic value. Horman has shown that cases presenting all the histological features of malignancy such as invasion of musculature by

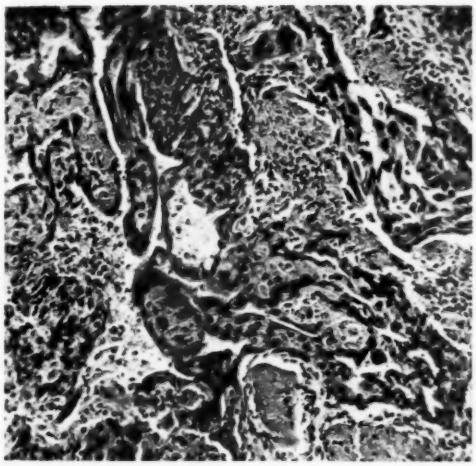

Fig. 8. Typical choriocarcinoma 2 years after curettage for hydatid. See Figure 6.

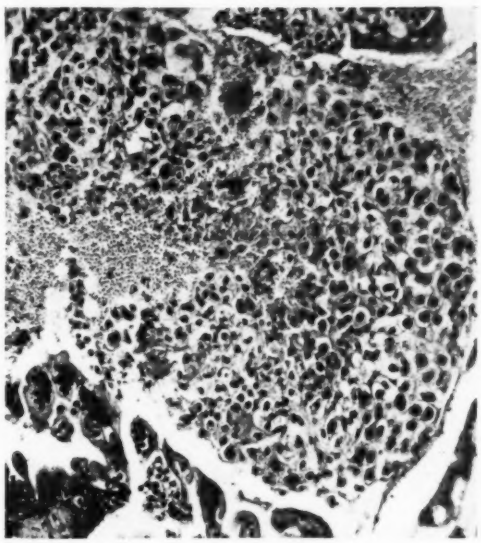

Fig. 9. Curettings showing hydatid mole and marked proliferation of both cell layers. Benign subsequent course. Illustrates difficulties of diagnosis and prognosis.

large cell masses, mitoses in fair numbers in the Langhans cells, leucocytic reaction, necrosis, thrombosis, and invasion of the vessels may have a perfectly benign course. On the other hand cases that histologically were more benign, showing absence of mitoses, villi, and signs of degeneration have gone on to a fatal issue. In my own series 3 cases diagnosed hydatid mole with proliferation of both cell types subsequently returned, one 2 months, the other 11 months later, with typical chorio-epithelioma; a third case returned 2 years later with atypical chorio-epithelioma. True, re-examination of the curettings, after the radical operation had made the diagnosis certain, disclosed microscopic fields that gave the impression of a possible malignancy, but nevertheless the picture was not sufficiently characteristic to warrant that diagnosis absolutely.

The histological study of our cases failed to show any definite relationship between the type of chorio-epithelioma and the preceding pregnancy. A normal or pathological pregnancy can give rise either to a typical or to an atypical chorio-epithelioma. It was noted, however, that the majority of the choriocarcinomata were antedated by an abnormal pregnancy, namely, a hydatidiform mole. The recorded statistics of many authors show that the majority of choriocarcinomata (50 per cent) follow a hydatidiform mole, while the remaining 50 per cent have, in about equal proportion, either a miscarriage with no abnormality in the placenta, or a normal pregnancy as its antecedent.

In the examination of various hydatid moles, histological pictures were found resembling malignancy, and yet these cases did well with no further treatment (Fig. 9). In isolated areas we may find more or less numerous appearances that to the best of our judgment cannot be differentiated from true choriocarcinoma and the subsequent course shows that these cases were benign. Naturally the complete eradication by the curette must be considered, but it must be conceded that the *individual cell power and the resistance of the host are conditions that the microscopical study of material cannot discern.*

We see the wide variations in the histology and we must accept the possibility of wide variations, not in the clinical course, for that in each group is strikingly similar, but in the prognosis. With this difficulty in prognosis goes the corresponding difficulty of setting proper therapeutic indication. Of course, in

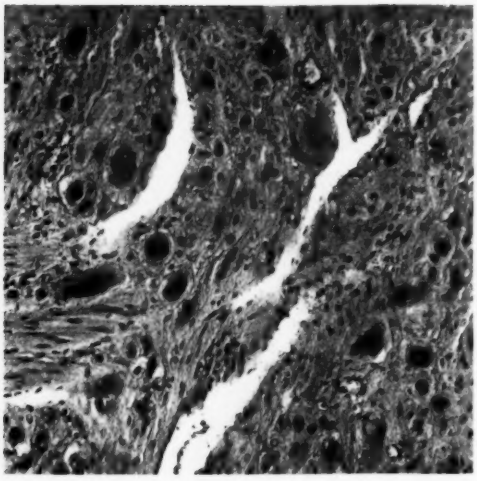

Fig. 10. Invasion of uterus by syncytial cells. Syncytial hyperplasia. No real tumor.

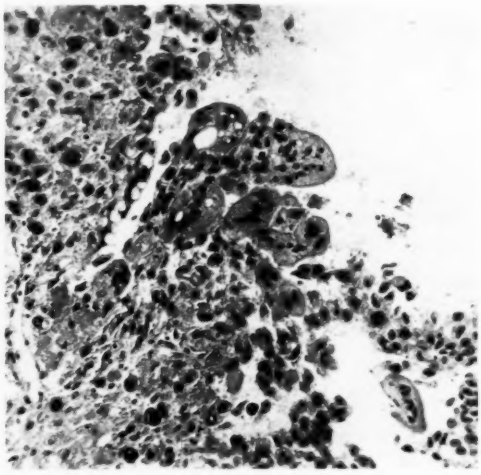

Fig. 11. Syncytioma. Mononuclear and multinuclear syncytial masses forming a definite uterine tumor.

those cases where a finger introduced into the uterus can feel an excavated tumor or where the histological evidence is clearly malignant, the indication is definite, but in those with a suspicious history and curettings that cannot be absolutely classed as choriocarcinoma, what is to be done? We feel that in view of the uncertainty of the prognosis with curettings of suspicious nature a hysterectomy is best suited to the case, for while an occasional uterus may be sacrificed more than an occasional life will be saved. True, it has been advocated to watch such patients closely and, with a recurrence of symptoms, to operate. While in many instances such advice is good, nevertheless the delay, especially after a curettage, may increase the risk by permitting such a tumor to grow or metastasize.

SUMMARY

1. There are two groups of tumors arising from the chorionic epithelium included under the term chorio-epithelioma: (a) the typical chorio-epithelioma better termed *choriocarcinoma*; (b) the atypical chorio-epithelioma better termed *syncytioma*.

2. There are numerous transition stages between these two groups.

3. A class really not a tumor, but a condition representing an exaggerated reaction to pregnancy, has been grouped under atypical chorio-epithelioma. For this class the term *syncytial hyperplasia* is suggested.

4. The diagnosis from curetted or expelled material is extremely difficult except in the clear-cut cases of the two groups.

5. Prognostic significance deduced from the histological structure is doubtful in the transitional types.

6. Indication for operation is set by a positive diagnosis of choriocarcinoma.

7. Indication to wait is determined by a positive diagnosis of syncytioma.

8. In cases of syncytioma, hysterectomy is indicated only by the clinical course.

9. In transitional cases hysterectomy is indicated.

10. Abdominal hysterectomy is the operation of choice.

11. Abdominal hysterectomy, if done early, gives fair prognosis in choriocarcinoma.

12. Abdominal hysterectomy gives excellent prognosis in syncytioma.

I wish to thank Dr. F. S. Mandlebaum, pathologist to the hospital, for the use of the material, the excellent photomicrographs, and his kind encouragement. I am also indebted to Dr. J. Brettauer and Dr. H. Vineberg for the use of the clinical data. The important literature on this subject has been ably compiled by Ewing, SURG., GYNEC. & OBST., 1910, x, 366–392.

PRIMARY OVARIAN AND PRIMARY ABDOMINAL PREGNANCY—THEIR MORPHOLOGICAL POSSIBILITY

Report of a Case of Each[1]

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ALTHOUGH the possibility of primary ovarian pregnancy is now universally admitted, there are still a number of critics who have not abandoned their skepticism. Up to the present time there have been reported at least twenty authentic cases whose primary ovarian origin has been conclusively demonstrated by careful microscopical study.

The literature of ovarian pregnancy takes us as far back as 1614 when the possibility of its occurrence was first suggested by Mercer and St. Meurice. No definite demonstrable histological evidence was, however, forthcoming, and with the accumulation of data concerning tubal pregnancy in its various modifications, it became doubtful whether the early cases were not really primarily tubal. The possibility of ovarian pregnancy was strenuously denied by Bland Sutton, Lawson Tait, and Webster although it was generally admitted by most of the German writers. In 1899, however, Catherine Van Tussenbroek published a careful histological description of an early case in which she demonstrated beyond question that the ovum could be imbedded in the ovary. Three years later, Thompson demonstrated a perfectly conclusive specimen.

There are those who deny the possibility of extra-uterine gestation other than ectopic pregnancy on the basis of the process of embedding of the ovum, contending that implantation is possible only in the loose subendometrial connective tissues and in the loose submucous connective tissues of the fallopian tubes and cannot occur in the dense stroma of the ovary or on the surface of the peritoneum. Some who grant the possibility of primary implantation in the last two situations, claim that the newly implanted fertilized ovum cannot develop much beyond the stage of a most primitive chorionic vesicle, in view of the extremely vascular bed requisite for the successful development of the ovum; others who consider that a decidua vera is essential to implantation contend that the epithelial layer of the follicle internal to the lutein cells offers a morphological antagonism to the development of a decidua.

The details of the process of embedding in the substance of the ovary are not fully known nor completely understood. The desideratum is a still earlier chorionic vesicle implanted in the gland than any thus far described.

Tussenbroek considered her case proved that the essence of ovarian pregnancy was implantation of the ovum in a graafian follicle, a conclusion which has not been borne out by recent cases. Teacher and Bryce's specimen shows definitely that embedding may occur outside the lutein follicle and in this respect their specimen is especially valuable in view of the fact that the stage of development reached by their chorionic vesicle was earlier than in any of the cases recorded even to the present day.

On the basis of the description of implantation and development of the earliest authentic human ova in the literature, namely, those of Peters, Leopold, Graf Von Spe, Teacher, Bryce, and others, the process as it occurs in the normal uterine site is sufficient to justify primary implantation in the ovary and certainly on the peritoneum. The very earliest phase of the process is best seen in the lower mammals such as the hedgehog, the mouse, and the guinea-pig, which, like the human, have not only a decidua capsularis and a discoid placenta but there are also marked resemblances in respect to the gross characters of human placentation; hence, these provide a competent analogy. From a combined study of these and of the earliest human ova, we may consider that the ovum reaches the uterus as a small blastocyst still enclosed in the

[1]From the Gynecological Service of Bellevue Hospital, New York City, William Studdiford, M.D., director; and The Pathological Laboratories Douglas Symmers, M.D., director

zona pellucida. The idea that the ovum becomes embedded in a utricular gland is no longer held by any one. The endometrium presents a perfectly smooth surface free from crypts or furrows with the exception of the mouths of the glands which are too minute in the undilated state to admit an ovum. The blastocyst, about 2 millimeters in diameter (approximately the size of a mature oocyte), comes to rest in a slight depression neither a crypt nor a fissure in the endometrium and contrary to the view of invagination of the endometrium, the ectoblast by a process of digestion or solution rather than by direct erosion or phagocytosis, probably in the nature of enzyme action, actively attacks the endometrium which is destroyed, leaving a gap through which the ovum enters. A continuation of the destructive activity on the mucosa and underlying connective tissues, leads to necrosis followed by solution (digestion) of a considerable mass of the endometrium, resulting in the formation of an implantation cavity. The mouth of the implantation cavity is plugged with blood clot, the cavity in the meantime having been filled with blood shed from the opened up maternal capillaries. We still are not able to say definitely whether the formation of a decidua is essential to implantation and certainly we have no evidence that decidual formation does occur prior to embedding. Indeed, from what occurs in the hedgehog, guinea-pig, and mouse, we may infer from analogy that the human ovum may embed itself in practically unaltered endometrium and this according to most embryologists is what occurs in the human. Changes leading to the production of decidua begin immediately after the solution of the endometrium and the elevation is formed corresponding to the areas of thickening described at the site of embedding of all the early human ova.

The ovum now rapidly differentiating, develops a thick trophoblast all around the blastocyst, and the most peripheral solid portions constitute the "trophoblastic shell." The trophoblast designates that portion of the fœtal ectoderm which does not share in the upbuilding of the embryo but only in the attachment and nourishing of the ovum. Very early, the trophoblast shows a cellular layer and a plasmodial layer. The ovum, at first free in the implantation cavity, becomes fixed first by outgrowing buds of plasmodium and later by the development of primitive chorionic villi. The plasmodial buds exert a destructive action which enlarges the implantation cavity, incidentally opening up the blood vessels and setting free blood which at first nourishes the ovum and later circulates among the trophoblastic processes. These considerations together with ovarian pregnancy exclude the theory that the uterine epithelium can have any part in the formation of the plasmodium and the idea of interlocking of fœtal and maternal tissues with derivation of the plasmodial layer of the trophoblast from maternal endothelium.

Let us digress for a moment to bring attention to an error frequently made by pathologists in reporting the histological findings in tubes, the seat of gestation, where a gross diagnosis of pregnancy is impossible, due to extensive destruction of the products of gestation and a portion of the tubal wall. They describe numerous chorionic villi infiltrating the tubal musculature together with multiple islands of "decidual cells." Decidual formation is purely of maternal origin arising definitely from the maternal connective tissues. The decidual islands are erroneously named since they are really cells from the trophoblastic shell, the processes of ectoblast which attach the ovum to the walls of the implantation cavity. Indeed, in any case of pregnancy, intra-uterine and extra-uterine, it has been definitely demonstrated that practically all the connective-tissue cells of the pelvic and abdominal regions and sometimes also of the thoracic cavity undergo a change in which the cells become swollen and clear so that the appearance approaches that of decidua. The author has observed this change in the appendix removed from a woman who had a tubal pregnancy. It can be observed in practically 95 per cent of all tubes removed for ectopic pregnancy and is most marked in the cells of the walls of the vessels of the tube. In our case of ovarian pregnancy, the walls of the vessels of the tube show the decidual change very strikingly in spite of the absolute

absence of any gross or histological evidence of gestation in the tube.

In all of the recorded cases of ovarian pregnancy, there is no formation in the ovary of a decidua. In this matter the early uterine ovum sheds light on the facts of ovarian pregnancy. We have pointed out the stage in the process of embedding in which destructive changes exceed or better, precede constructive decidual changes. The formation of a decidua in the immediate neighborhood of the ovum is not essential to its embedding. The blastocyst implants itself in connective tissue which is best capable of reacting to the stimulus of an irritant or foreign body. In the uterus, tube and ovary alike the reaction is manifested first by enlargement of the vessels, followed soon in the case of the uterus by extensive decidua formation. In the ovary, the actively destructive changes persist to a later stage. These facts indicate that decidua formation is a provision of conservative nature, by which during the early months the activities of the trophoblast are limited and controlled until such time as placentation is complete.

From the analysis of all the previous cases and our own specimen, it is apparent that considerable variety occurs in the embedding of the blastocyst in the ovary, more especially in respect to its relations to the corpus luteum. Upon one point all observers are agreed, *viz.*, that the layer next to the fœtal tissue is connective tissue in some form and that the lutein cells do not play the part of decidua; certainly, they appear to play no part histologically in the attachment of the ovum. The tissue in which the ovum is embedded and subsequently becomes attached, represents the young connective tissue which is formed within the lutein tissue or theca interna in the first stage of organization of the contents of the ruptured follicle.

From application of these data, it will be seen that there are two possible situations in which an ovum impregnated within the graafian follicle may become embedded.

Embedding commences while the ovum is still a very minute object, little if any larger than the mature unfertilized ovum. Such a minute body readily finds a nidus in the thin layer of young connective tissue within the follicle.

Fig. 1. Case 1, C. O. Photograph showing intact tube with orange-sized hæmorrhagic mass replacing the ovary. The deficiencies in tube correspond to area from which portions were removed for section.

On the other hand it is generally admitted that the primary and essential factor in determining the effective implantation of the ovum is a rich blood supply. In this event, the conditions just external to the layer of lutein tissue are still more favorable, and accordingly it appears that the ovum burrows out of the follicle into this layer. This accounts for the thin layer of connective tissue which separates the villi from the lutein cells in our case and in practically all previous cases in which the relation to the corpus luteum has been histologically demonstrated. As the process continues, the destructive process causes a gradual disappearance of the lutein tissue so that in the final issue, the initial evidence for the site of implantation disappears and hence we have on record the report of cases of primary implantation in the substance of the ovary (Hewetson and Jordon-Lloyd) a morphologic impossibility.

In short, the factors of ovarian pregnancy appear to be fertilization and retention of the ovum within the graafian follicle, or in its immediate neighborhood, until such time

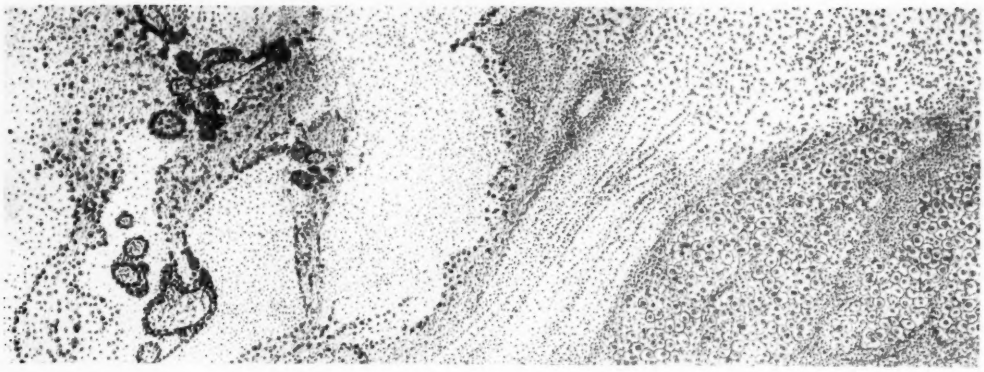

Fig. 2. Case 1. C. O. Drawing showing corpus luteum, ovarian stroma, and organizing blood clot with infiltrating chorionic villi and fœtal trophoblast.

as it becomes capable of embedding itself by its own activities, when it may do so in any patch of connective tissue sufficiently large to accommodate it and sufficiently vascular to meet the demands of its nutrition.

Both cases discussed below occurred in Bellevue Hospital, New York, in the service of William Studdiford, whose permission I have to use the clinical record.

C. O., age 38, married, was admitted June 26, 1918, to the gynecological service of Bellevue Hospital with the complaint that 3 days before admission, she was suddenly seized with an intense knifelike pain in the lower abdomen. She fell to the floor in a faint. A similar attack recurred one night before admission. The pain radiated to the perineum and rectum and there was straining and pain on defæcation and burning on urination. There was no discharge of blood or other material from the vagina. The family and previous histories were negative. She had been married 2 years, had no children, but one miscarriage in the fourth month; menstruation began at 14, lasted over 3 or 4 days, occurred at irregular intervals and was always accompanied by dysmenorrhœa. Last menstrual period occurred May 4 and there had been no bleeding since.

Physical examination revealed a systolic murmur at the apex and some tenderness over both iliac fossæ, particularly on the left. There was no rigidity. The bimanual examination under ether showed a large soft boggy mass on the left side. Laparotomy showed the uterus to be normal in size and displaced to the right; the right tube and ovary were normal; the left tube was slightly œdematous but otherwise completely intact; milking brought no fluid from the fimbriated extremity. The ovary was replaced by a large, globular, hæmorrhagic mass enclosed in a thin capsule which was broken in several places allowing the protrusion of blood clots. The abdominal cavity was distended with fluid and clotted blood. The macroscopic diagnosis of "ovarian cyst with torsion of the pedicle" was made and hence the specimen was not photographed until the true nature of the condition was revealed in the laboratory. The patient made an uneventful recovery.

Pathological Report. Macroscopical examination. Specimen as received in the laboratory consisted of tube and ovary with large amount of blood fluid and clotted. The tube measured 12 centimeters long and the peritoneum was slightly congested. Fimbriated extremity was patent and showed no naked-eye changes; milking of the tube toward the fimbriæ brought no fluid of any kind. A fine probe passed through the fimbriated opening was obstructed at the junction of the inner and outer two-thirds; cross section here revealed no lumen to the naked eye.

The ovary was replaced by a large orange-sized hæmorrhagic mass which was irregularly broken in several places with the protrusion of blood clots through the deficiencies. The mass occupied the position of the ovary, and spread over one-fourth of its circumference was a pale grayish, slightly elevated area of irregular thickness corresponding apparently to the cortex of the ovary. The entire mass was made up of an acutely injected and granulated material, for the most part blood clot, throughout which there were irregularly scattered numerous small, pale yellowish, coarsely granular bits of tissue, suggesting in places, disintegrated corpus luteum.

Microscopical examination (40 sections examined). Sections from hæmorrhagic mass revealed everywhere, numerous chorionic villi embedded in the stroma of the ovary. There were a number of scattered giant masses corresponding to syncytium and large islands of swollen, richly chromatic cells identical with the cells of the trophoblast. Several of the sections revealed portions of the wall of the corpus luteum separated from numerous perfectly typical and well preserved villi by a thin layer of

blood clot, connective tissue of the gland, and some stroma. A portion of the blood clot showed some newly formed blood-vessels and fibroblasts. The connective-tissue lamella applied to the strands of trophoblast were necrotic, while still further away there was an evident inflammatory reaction characterized by dilatation of the blood vessels and large collections of polynuclear leucocytes and small lymphocytes. At a still deeper plane, normal connective tissue was reached. Nothing resembling a true decidua as it occurs in the uterus was seen, but the peculiar decidual change in the connective-tissue cells of the gland and more particularly in the walls of the blood vessels was very marked.

Sections from the tube revealed slight congestion and œdema of the subperitoneal connective tissue; the outer two-thirds of the tube was otherwise unchanged. The inner third showed marked involution with practical obliteration of the lumen, *i.e.*, a chronic obliterating salpingitis.

Spiegelberg in 1878 formulated certain criteria which he held must be fulfilled in order to justify a diagnosis of ovarian pregnancy. He demanded (1) that the tube on the affected side be intact; (2) that the fœtal sac occupy the position of the ovary; (3) that it be connected with the uterus by the ovarian ligament; and (4) that definite ovarian tissue be found in its wall. Our case not only meets all of these requirements but in addition establishes the relation of the process to the corpus luteum.

A. K., age 24, single, was admitted December 13, 1918, to the gynecological service of Bellevue Hospital with the statement that on the night previous to admission, she was suddenly seized with severe cramp-like pains in the lower abdomen. The severity of the pains increased progressively and she fainted twice on the morning of admission. The family and previous histories were negative. Menstruation began at 12 and was always regular, occurring every 24 days, lasting 3 to 4 days, and always with some dysmenorrhœa. On admission there was a bloody vaginal discharge which the patient said was her usual menstrual period. The preceding period occurred December 8, 1918, and was apparently a normal one. She denied emphatically the possibility of pregnancy.

Physical examination showed a young white female acutely ill and extremely pale. The abdomen was distended, tense, and showed a fluid wave. There was generalized abdominal tenderness with the maximum point of tenderness in the mid-line just above the symphysis.

Examination under ether showed the uterus in front and a soft boggy mass in each fornix. Dilatation and curettage brought forth a small amount of apparently normal endometrium. Laparotomy revealed a peritoneal cavity distended with fluid and clotted blood. Uterus and adnexa were delivered and both tubes and ovaries found to be absolutely normal. On the anterior wall of the uterus, just above the level of the internal os and slightly to the right of the mid-line, was a large pea-sized ragged area oozing blood from the center. At the time of operation an attempt to pass a sharp probe through the center into the uterus met with no success and the small pathological site was regarded as a new-growth. The supposed growth was excised, the gap closed by interrupted sutures and the raw surface covered by a fold of bladder peritoneum. The patient made an uneventful recovery.

Fig. 3. Case 2. A. K. Drawing showing implantation of chorionic villi and syncytial cells on peritoneal aspect of uterus and underlying myometrium. Note the acute inflammatory reaction manifesting itself by diffuse and perivascular small round cell and eosoniphilic infiltrations.

Pathological report. Macroscopical examination. The specimen as received in the laboratory consisted of a small irregular piece of tissue 12 millimeters long by 7 millimeters wide. It consisted for the most part of a rather firm, yellowish gray tissue which showed on the peritoneal surface an area of hæmorrhagic infiltration extending downward for a depth of 3.5 millimeters.

Microscopical examination (8 sections examined) of tissue internal to the hæmorrhage revealed muscle bundles with the usual arrangement of myometrium. Approaching the peritoneum, the muscle fibers became looser and the vessels engorged showing dense perivascular round-celled infiltrations. Here

also, the peculiar decidual change affecting the connective-tissue cells and particularly the cells in the walls of the vessels, was very striking. More peripherally there were irregular areas of hæmorrhage throughout which were numerous collections of polynuclear leucocytes and small round cells; at the extreme periphery and actually implanted in the myometrium were numerous typical, wellpreserved chorionic villi. Adjacent to the villi were several groups of large, richly chromatic trophoblastic cells.

Interpretation of pathological findings: In concluding, primary abdominal pregnancy three possibilities had to be eliminated:

1. Abortion with perforation of the uterus and protrusion of placental tissue. The patient emphatically denied instrumentation or even that she was aware of being pregnant. The external os was perfectly virginal and free from any evidence of instrumentation. Furthermore, it would be a mechanical difficulty if not an impossibility to perforate the uterus with a sound in the region which was the site of the pathological process.

2. A perforating chorio-epithelioma. Curettage produced normal endometrium; the uterus was practically normal in size; the myometrium toward the uterine mucosa was free from chorionic villi and the patient made an uneventful recovery.

3. Tubal abortion with secondary implantation on the peritoneum of the anterior uterine wall. The tube was absolutely free from any evidence of pregnancy gross or microscopic. The inner third of the tube was involuted and the lumen obliterated; the outer two-thirds were histologically normal. The fimbriated extremity was patent, the fimbriæ unchanged and the tube in its entirety was free from adhesions.

I wish to make grateful acknowledgments to Dr. Thyng, professor of embryology, Bellevue Medical College, for assistance in obtaining some of the earlier references; to Dr. Douglas Symmers and Dr. Charles Norris, of New York, and Dr. S. Haythorn and Dr. Oscar Klotz, of Pittsburgh, for their kindness in reviewing the cases and the pathological findings.

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REPAIR OF PARTIAL AND COMPLETE LACERATIONS OF THE PERINEUM

By A. GOLDSPOHN, M.S., M.D., F.A.C.S., Chicago

FOR twenty-five years I have made use of the operation herein described. Under the title "Intrapelvic and Infravaginal Perineorrhaphy without Loss of Tissue," I described the technique, briefly in 1897 (1) and in 1901 in more detail and with illustrations (2). Inasmuch as at this time and again in 1914 I cited the contributions to the literature on the subject by the meritorious contributors who preceded me (3), I will omit this phase now and discuss only the practical and important features.

The profession is pretty well agreed that all former standard operations for the treatment of lacerations of the perineum were merely vaginal resections of variable depth and extent, without restoration or improvement of the real weight-bearing structures beneath them. Mistaken conceptions of the anatomy of the female perineum have caused errors in the technique of operation for lacerations of it, and it is with the hope of clarifying these mistaken conceptions that I describe my findings. That a renuion of the bilateral backward-extending portions of the levator ani muscle and its fasciæ near the median line between the rectum and the vagina is the chief desideratum, is generally admitted and striven for; but about the exact location and the accessibility of the levator ani muscle, there is still much difference of opinion; and, frequently, more superficial structures are mistaken for it. Because the levator ani lies, normally, in a bilaterally receded position within the pelvis, behind the narrower introitus, it will not of itself, in any dissection, come out toward the median line into plain view within the lumen of the wound. It will appear so only after it has been drawn to the median line and is held there. Therefore, all who represent it as lying there naturally or voluntarily, are mistaking other structures for it—probably the narrower and firmer urogenital diaphragm, the trigone, or triangular ligament that will thus appear in the wound or dissection.

The puborectal and pubococcygeal portions of the levator ani in its fasciæ, the parts in which we are interested, can be felt plainly with a finger in the vagina of a nulliparous woman, when it is passed with moderate pressure over its lateral walls. Close under the symphysis pubis these levator parts lie, indeed, quite near or upon the trigone, triangular ligament; but they extend downward and *backward* from there, so that, when they reach the level of the rectum, they are 5 to 6 centimeters inward from the plane of the hymen; and not merely "half an inch or less," as is stated by Sturmdorf (4) and by Jellett (5), and as is inferred from the operative technique of a number of other authors. And it is closely upon the rectum that the union of the levator parts must be made, to construct a bridge 5 to 6 centimeters wide, directly over the bowel, to hold it down properly, and not merely to form a bar across the introitus internally. Operating at a depth less than 5 to 6 centimeters inward from the hymen, can, therefore, not usually fulfill the correct anatomical requirements.

Fig. 1. A drawing of a manikin constructed after illustrations by Gray and Liepmann. A cross section of the ischiorectal fossa (*a*) and of the levator ani muscle with its fasciæ (*b*), is represented. The internal pudic artery (*d*) guarded by the obturator fascia (*c*) lies upon the outer side of the ischiorectal fossa at a safe distance.

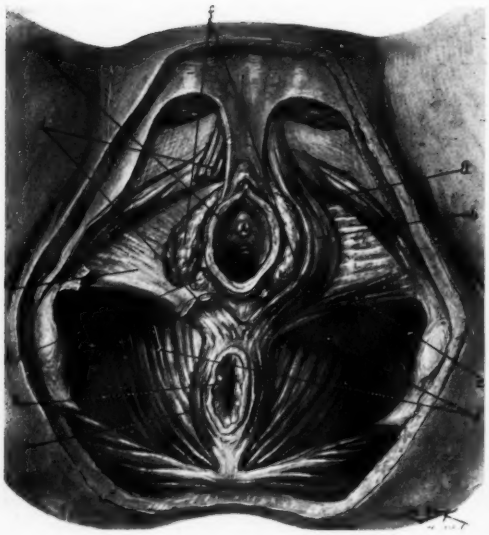

Fig. 2. Labia, skin, subcutaneous fat, superficial perineal fascia, and contents of the ischiorectal fossæ are removed. The ischiocavernosus (*a*), bulbocavernosus (*b*), and superficial transversus perinei muscles (*c*), (belonging to the superficial stratum) are intact on the left side; but the latter two muscles (*d*) are cut away on the right side to expose the urogenital diaphragm (*e*) (the middle stratum) on that side. The bulbi (*f*), Bartholin gland (*k*), vulva (*g*), and the anus (*h*) with the external sphincter (*i*), are intact. The levator ani muscle (*j*) constituting the innermost stratum is divested of its outer fascia. (From Edward Martin's *Atlas*, Plate XII.)

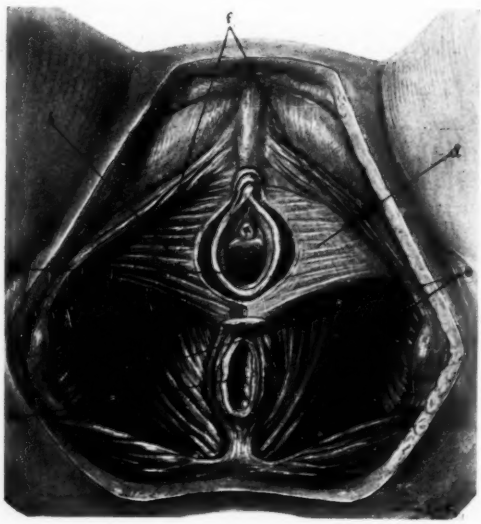

Fig. 3. The chief muscles of the outer stratum and the bulbi have been removed. The urogenital trigone, septum, or triangular ligament (the middle stratum) composed of two layers of fascia with the deep transversus perinei muscles between them, is intact on the right side (*a*), but its outer aponeurotic layer has been removed on the left side to show the fibers of the transversus perinei profundus muscle (*b*) within. The anus (*c*), the vulva (*d*), and the levator ani (*e*) are intact as before. The crura of the clitoris (*f*) are shown, the left one in its relation to the ischiocavernosus muscle. (From Edward Martin's *Atlas*, Plate XIII.)

The anatomy of the female perineum becomes clearer when grossly divided into three strata, as is done by several French and German anatomists: The first embraces the subcutaneous tissues and superficial muscles, the bulbocavernosus, ischiocavernosus, and superficial transversus perinei. The second layer is called by several anatomists the urogenital diaphragm, or trigone. By others it is erroneously called the triangular ligament, a name that suggests nothing of its composite structure consisting of two layers of fascia with a muscle, transversus perinei profundus, between them. This dense, strong, and more inelastic formation fills in the angle formed by the descending pubic and ascending ischial rami, back to the anterior border of the anus. It closely surrounds the vaginal introitus near the hymen and forms a firmer and narrower boundary around that passage than the levator ani does. Its inner borders are more easily exposed and made to stand out plainly. The *third* layer is made up of the levator ani muscle, which is lined on its upper or visceral side by the rectovesical fascia and covered by the ischiorectal or anal fascia on its under or outer surface. It is as important to engage these fasciæ for service as to engage the muscle itself; for here as well as elsewhere in the abdominal parieties, constant tension would tire out the muscle if it were not backed up by fascia to give it periods of rest.

The anatomy is fairly exhibited by the accompanying drawings, which are exact representations of most careful and authentic dissections of specially prepared female pelves, and which were made by Edward Martin (6) under the supervision of Waldeyer. They are corroborated by the special anatomical studies of these parts by Tandler and Halban(7),

Fig. 4. All the structures of the superficial and middle strata have been removed up to the margins of the rectum (*a*) and vagina (*b*) that have been carefully preserved, the latter as a projecting collar, which is surrounded by the remaining edge of the fascial trigone (*c*). The ischiorectal fossæ have been cleared out and the muscles in their walls —the levator ani (*d*), the internal obturators (*e*), and the pyriformi (*f*) have been divested of their fascial coverings. (From Edward Martin's *Atlas*, Plate XIV.)

Fig. 5. Dissection showing the three main strata of structures in the female pelvic floor, and the three layers of the urogenital trigone, septum, or diaphragm (middle stratum). Superficial fascia (*a*), superficial transversus perinei muscle (*b*), and sections of the bulbocavernosus and ischiocavernosus muscles (*c*), together composing the outer stratum. The outer fascia of the trigone (*d*), the inner fascia (*e*), and the deep transversus perinei muscle (*f*) between these, together constitute the fascial diaphragm. The levator ani muscle, the innermost and chief stratum (*g*). (From Edward Martin's *Atlas*, Plate XIV.)

W. Liepmann (8), and Hugo Sellheim (9). Figure 1 shows that the one considerable artery in these parts, the internal pudic, lies on the outer wall of the ischiorectal fossa, at a sufficient distance to make it safe to pick up the levator structures, down near the rectum, with a needle guided by one or more fingers of the opposite hand. Only venous bleeding occurs, which stops readily when the wound cavity is obliterated in all its parts by the buried suturing. Figure 2 shows the superficial muscles of the first stratum *a*, *b*, *c*, intact on the left side; but two of them are cut away on the right side, so as to show the outer surface of the second stratum, the urogenital diaphragm (triangular ligament), on that side. Figure 3 shows this urogenital diaphragm, the trigone, or triangular ligament. Its outer fascial layer has been removed on the right side to show the deep transversus perinei muscle, which constitutes the middle layer of this three-ply structure whose inner borders constitute the most distinct and resistant structures about the vaginal introitus. Figure 4 represents the innermost stratum, the levator ani muscle whose outer fascia has been dissected off. Figure 5 is a dissection of the median line and one side of the perineum, which shows parts of each stratum, in sections.

As to operative technique Figure 6 shows about the usual first incision at the mucoskin junction. From there the posterior vaginal wall is dissected up in a flap; bluntly, when possible; or, if necessary, with blunt-pointed scissors as shown in Figure 7. It is raised inward for a distance of 5 to 6 centimeters, or

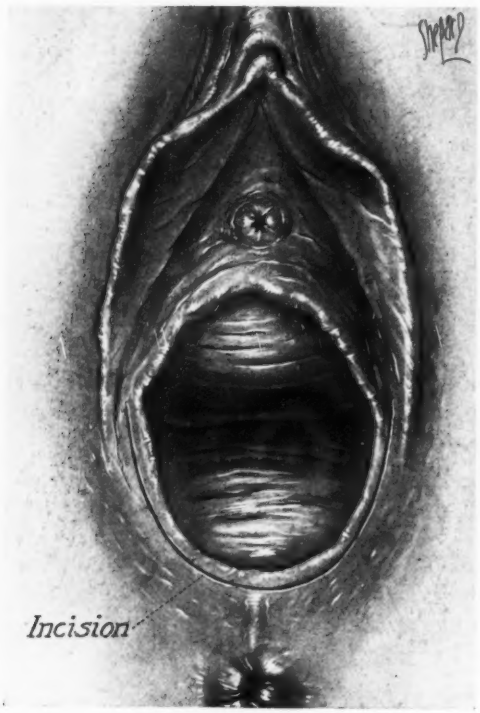

Fig. 6. Line of first incision at mucocutaneous junction.

Fig. 7. Method of raising the vaginal flap, its thickness being always noted by one or two fingers of the left hand on its upper side and opposite the points of blunt or sharp dissection, to avoid injuring the rectum. No such sharp pointed scissors should be used.

more, from the plane of the hymen to a point 1 to 2 centimeters beyond the previously located proximal border of the levator ani structures, that have sometimes receded, and on the sides to the level of the white line of the pelvic fascia, as shown in Figure 8. The

Fig. 8. The posterior vaginal wall must be raised to a distance of from 6 to 8 centimeters inward, and laterally to the level of the white line in the pelvic fascia of each side.

Fig. 9. The levator ani structures are seized upon each side, closely over the rectum, without sight, in a pool of blood, at a distance of 6 to 8 centimeters inward from the skin edge of the wound.

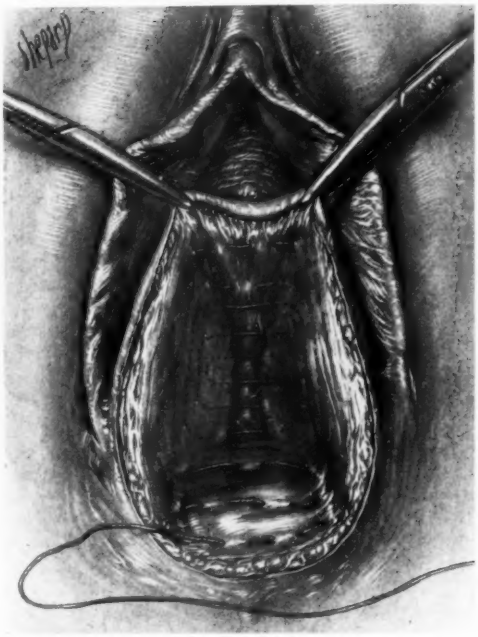

Fig. 10. After the levator has been sutured separately, the remaining wound is closed from side to side from within outward by a continous chronic catgut suture passed continuously and knotted at every second or third round. The skin wound is closed vertically by interrupted silkworm-gut sutures or subcutaneously with chromic catgut.

Fig. 11. Shows incision in vaginal mucosa. From its inner edge (*a-a*) a flap is raised to restore the pelvic floor; and from its outer edge (*b*), the flap is dissected outward for the plastic upon the rectum and anus.

levator muscle is traced best by its tense fasciæ between which it lies. It should not be dissected out from these, but should be picked up with them as a composite mass because the fasciæ are fully as important as the muscle which alone would be of little service. Splitting of these parts and uniting them in layers, as is illustrated by George H. Noble (10), is not advisable, because it will simply weaken them. It would take more time than all the rest of the operation; and it would be difficult to do, down upon the rectum, in a pool of blood, where the union of the bilateral parts should be made. After having been uncovered and located by touch alone, the levator structures are seized, at the side of and over the rectum, by a full curved and non-cutting needle, held in a good needle-holder, and armed with a double thread of chromic catgut. The seizure is made under the guidance of the index finger of the left hand, which holds the rectum out of the way by maintaining an intermediate position between it and the needle point, as shown in Figure 9. The serviceability of the structures seized is tested by making a pull upon them with the needle, and another grasp is made if deemed necessary. The needle is drawn through and carried directly across to the levator structures of the opposite side, which are hooked up in the same manner, under the guidance of the same finger that holds the rectum out of the way, and which stands guard here between the bowel and the needle point, as shown in Figure 9. When a satisfactory seizure has been made on this side also, the needle is drawn through and carried back to the first (left) side, and a second suture of the same kind is placed with equal care, seizing the levator structures at points a little posterior or anterior to the first one, in order to

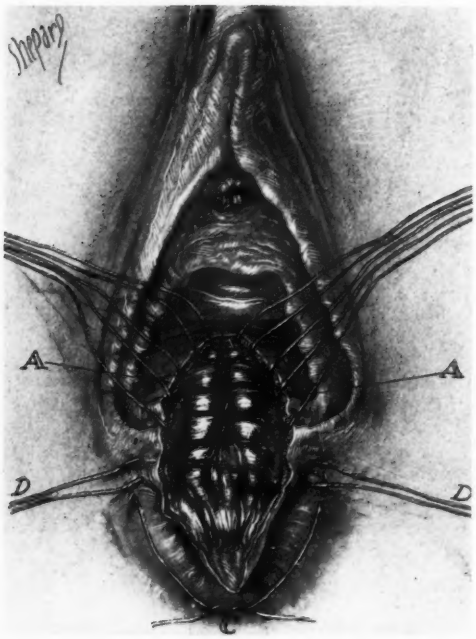

Fig. 12. Shows the outer flap (*b*), turned down over the anus. The rectal tear is closed over the everted flap, by interrupted sutures of chromic gut, that do not come in contact with the bowel mucosa; and tension upon them is avoided by the tension stitch (*c, d, d*). Sutures approximate ruptured ends of sphincter muscle.

Fig. 13. At the close of this operation for complete laceration, the tip of the everted flap will project from the anus and may be trimmed and stitched to the anal border.

secure a wider approximation. The suture is then tied, thus bringing the most important weightbearing parts into direct union with no other tissues intervening. After this, the remaining wound is closed, from within outward to the subcutaneous tissues, by the use of the same deep suture circuitously, as shown in Figure 10, with an occasional knot tied in it. In taking each of these stitches care is used to grasp a substantial piece of the lateral weight-bearing structures, notably of the trigone; this obliterates the wound cavity and stops the venous bleeding by repeatedly but gently picking up the areolar submucous tissues in the bottom of the wound, as well as on the under surface of the vaginal flap which, thereby, becomes adjusted in small ruffles as a fastened covering of the newly constructed rectovaginal septum. The vaginal flap, thus arranged in small folds and fastened to the united bearing structures beneath it produces a more massive and durable septum than could be obtained if it were cut away. Of this puckered flap a small tip only is cut away; and then an interrupted silkworm, or chromic catgut, stitch is placed which takes in the adjacent sides of the skin wound and the ruffled edge of vaginal flap, in the manner of a purse string. The remaining skin wound is closed with similar interrupted stitches, or in a subcuticular manner, as may be preferred. All the weight-bearing structures are broadly and directly approximated near the median line, which cannot be accomplished by figure-of-eight sutures ever so deeply placed, because the latter bring in non-essential tissues which interfere with direct union of the important structures; they, too, violate a general rule concerning normal anteversion

of the uterus, that the posterior vaginal wall should not be shortened.

In cases of complete laceration into the rectum, the flap or apron method described by Ristine (11) in 1899 is made use of for the rectal tear and for the external parts, in combination with the operation described for restoration of the pelvic floor. An incision through the vaginal mucosa only, in the form of an inverted letter V, is made upon the posterior vaginal wall, about 2 centimeters distant from the edges of the tear in the rectum. The ends of this incision must pass to points about 1 centimeter outside of the retracted ends of the torn sphincter ani, and a little beyond them, as shown in Figure 11. Beginning at the inner border of this incision, (*a-a*) the posterior vaginal flap is raised inward far enough to deal with the levator structures, which are traced and united; and the inner part of the wound is dealt with as described for incomplete laceration, out as far as the V incision. From the outer edge of the incision, Figure 11, *b*, the vaginal mucosa is then very carefully dissected outward, in a flap without perforation, to the edge of the tear as shown in Figure 12. After the retracted ends of the torn sphincter ani have been exposed, they are grasped with rat-tooth forceps, and the muscle is stretched moderately. Its ends are then brought together over the raw surface of the flap and united by chromic catgut re-enforced by a silkworm-gut suture. The edges of the wound above are approximated, and the cavity beneath is closed with fine chromic gut. To relieve the tension on all sutures engaged in this plastic procedure, a submucous silkworm-gut suture is passed around it within the rectovaginal septum. This is tied with moderate tension beneath the tip of the flap which, usually, projects downward within the new anus. This can be left to slough or shrink away; or it may be trimmed off if it is too massive.

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NORMAL SEPARATION OF THE PLACENTA

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UP to the present time, knowledge concerning premature separation of the placenta has been faulty, due to erroneous conceptions regarding the physiological separation of the secundines. For this reason a thorough study should be made of the process of normal separation of the placenta. The simple events during the third stage of labor have been studied by numerous investigators who have employed various methods of examination, namely, in chronological order: palpation of the abdominal wall, vaginal exploration, and X-ray examination, the last being advocated particularly by Weibel. The exact details of the physiological process have not been studied by many.

Theoretically there are three ways in which separation of the placenta might take place: first, by enlargement of the area of insertion following the evacuation of the uterus; second, by hæmorrhage between the placenta and uterus; and third, by expulsion of the foreign body as a result of uterine contractions. Franz thinks that separation must be produced by certain factors which are active during the second and third stages of labor; the diminution of the inner surface of the uterus, and the labor pains occurring at the end of the second and during the third period of labor. These two factors are emphasized in different ways by different authors. In former times the last pain of the expulsion period was believed to play an active rôle in the process of separation. More recent authors, among them Weibel, who used the X-ray in studying the third stage of labor, contradict this theory. It is now certain that immediately after the expulsion of the child the placenta is fully adherent to the uterine wall.

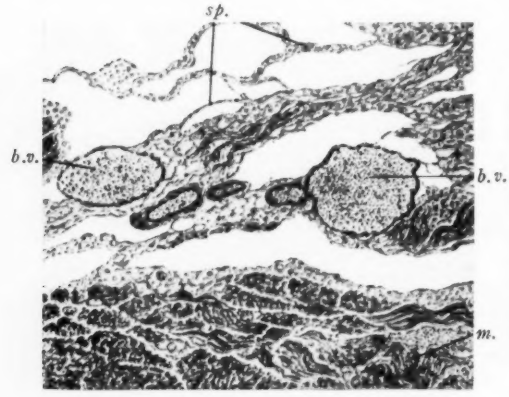

Fig. 1. Decidua serotina of a pregnant uterus at term. Placenta attached after expulsion of infant. *m.* Musculature, *sp.* trabeculæ of spongiosa, *b. v.* blood vessels.

Almost all authors lay particular stress on the importance of contractions during the third stage of labor. Among the many authors who have emphasized this point, Bumm ranks foremost and I cite his description literally. "By contractions of that part of the uterine muscle which carries the placenta, the latter is more and more removed from its area of insertion. . . . This separation is introduced by intense muscular contractions."

Special importance has been attributed by most authors to the diminution of the area of insertion of the after-birth. More recently Hohenbichler has advanced the theory that torsion of the umbilical vessels due to the sudden filling of the latter after the expulsion of the fœtus plays an important rôle in the removal of the secundines. It is obvious that this peculiar conception cannot possibly withstand scientific criticism. There are many facts which are incompatible with the idea that uterine contractions and the diminution of the area of insertion are active factors in separating the placenta from the uterine wall.

I fully agree with Weibel who believes that the placental separation is in no way coincident with the labor pains of the third stage. I have observed numerous cases in

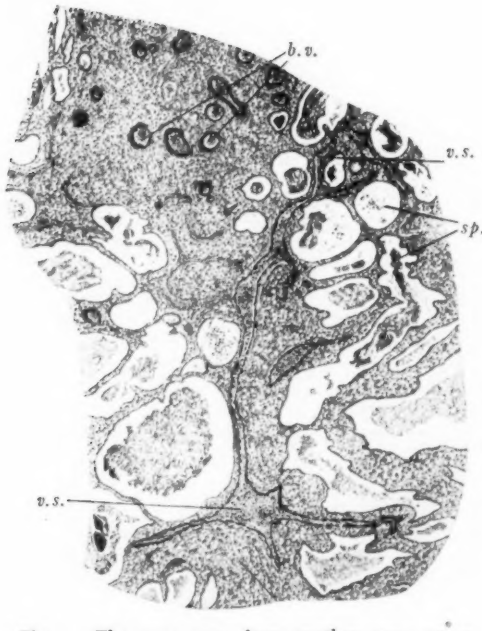

Fig. 2. The same area, from another case. *sp. s.* spongiosa sinuses, *b. v.* blood vessels, *v. s.* vascular sinuses.

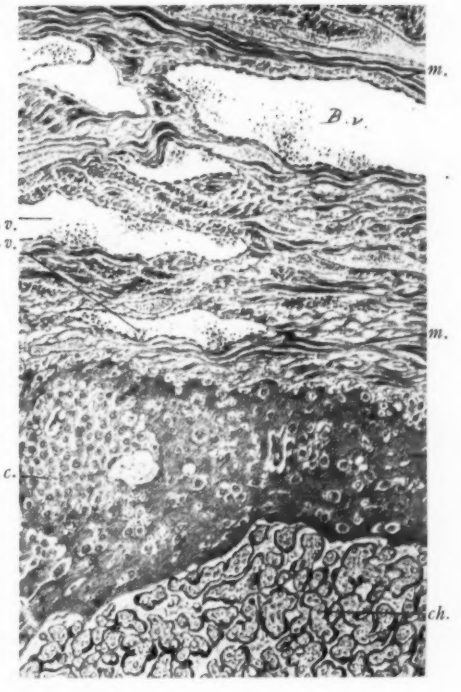

Fig. 3. The same section as Figure 1. Portion without spongiosa. *m.* Musculature, *b. v.* blood vessels, reducing the muscle bundles to thin septa, *d. c.* decidua compacta, *ch.* villi.

which palpation as well as close observation of the patient did not permit conclusions regarding the separation of the secundines. Yet, separation occurred and the placenta dropped very promptly into the lower portion of the uterovaginal tube. We have observed also two very interesting cases of cæsarean section, which showed plainly that uterine contractions occurred only after the formation of the retroplacental hæmatoma and after complete separation of the placenta.

I believe also as does Hofmeier, that the placenta possesses to a great extent the ability to adapt itself to changes in the size of its surface of insertion. Otherwise it would be difficult to understand how the placenta could withstand all the insults of intense uterine contractions during labor, unless it were a very flexible, ductile, and at the same time, compressible structure.

It is important to note that the uterine wall, in the area of insertion is very much thinner than the rest of the corpus musculature of the same level. Schroeder's atlas and Bumm's textbook show in their illustrations that the thinned portion of the uterine wall bulges almost like a hernia above the rest of the uterine surface. All authors assume that the thinner portion of the uterine wall, after expulsion of the fœtus acquires the same thickness as the remaining corpus musculature. This causes diminution of the inner surface which is followed by rupture of the trabeculæ of the decidua spongiosa. I cannot agree with the statements of these authors, because the thin uterine musculature attached to the placenta must withstand powerful contractions for a long time before the onset of the third stage of labor. Why should not separation occur during the period of expulsion, which is accompanied by intense muscular contractions? It is also improbable that intra-uterine pressure plays an important rôle in the pre-

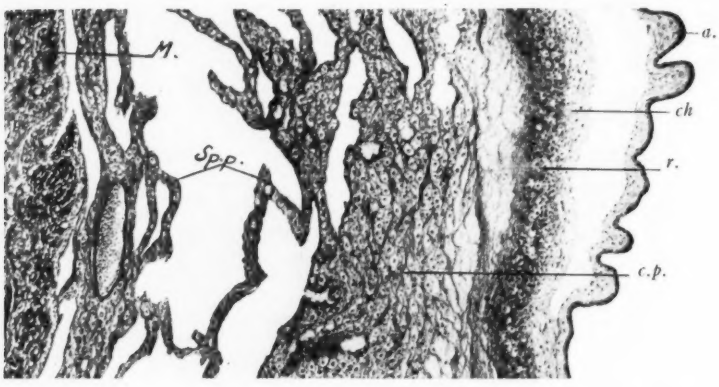

Fig. 4. Membranes *in situ*. *m*. Musculature, *sp. p.* spongiosa of the parietal decidua, *c. p.* compacta of parietal decidua, *a*, amnios membrane, *ch*. chorionic membrane, *r*. reflexa, in involution, connected with the compacta basalis by loose tissue bundles.

vention of rupture of the trabeculæ of the decidua spongiosa.

It is my opinion that the musculature attached to the placenta remains thin as long as the placenta is attached to it. Intense contractions of the uterine muscle are impossible while the placenta is attached to the inner surface of the uterus. Such contractions will occur only, after separation has been effected by other happenings. We can readily prove this by the examination of microscopical sections of uteri, to which the placenta is attached after expulsion of the fœtus has taken place. Of the two specimens, which I have in my collection, one was obtained 2 years ago from a patient who died from influenza.

We know that placental separation is effected within the decidua spongiosa. Figure 1 shows clearly that the trabeculæ of the spongiosa are extremely delicate and contain vessels greatly dilated with blood. The thin walls of the vessels protrude in most places beyond the outlines of the trabeculæ. Figure 2 shows many compacta vessels, which in the area of the spongiosa become enlarged and form branched vascular sinuses. The hyperæmia *ex vacuo*, following the expulsion of the fœtus, produces a greatly increased influx of blood into the decidua as well as into the muscularis. Rupture of the above mentioned decidua spongiosa sinuses and vessels which are deprived of any support by decidual tissue follows this intense hyperæmia. Up to this point neither contractions nor diminution of the area of adhesion plays any active rôle in placental separation and the production of the retroplacental hæmatoma. After the formation of the hæmatoma between the placenta and uterus, the musculature is capable of contraction and will become thickened to the extent of the corpus musculature of the same level. It is therefore certain that neither muscular contractions nor diminution of the area of insertion of the placenta is the cause of the separation of the after-birth, but rather the result of it.

Wherever the spongiosa is absent, one finds that numerous large blood sinuses are present in the musculature adjoining the placenta (Fig. 3). Between these sinuses are very delicate fragile muscle bundles, which play the same rôle as do the trabeculæ of the spongiosa, where the latter is present. This explains why one sometimes finds smooth musculature on the maternal surface of the expelled placenta.

The separation of the membranes is effected by traction exerted by the separated placenta, and occurs either within the trabecular portion of the spongiosa or, more frequently, within an area of certain loose fibers, lying between the compacta of the parietal decidua and the decidua reflexa (Fig. 4).

DEPARTMENT OF TECHNIQUE

PLASTIC PROCEDURES FOR THE OBLITERATION OF CAVITIES WITH NON-COLLAPSIBLE WALLS[1]

By ALLEN B. KANAVEL, M.D., F.A.C.S., Chicago

THE closure of cavities with non-collapsible walls at times presents problems of the keenest interest to surgeons. Such procedures may be a necessary adjunct to operative intervention where suppuration in a cavity cannot be controlled, as for example following osteomyelitis, empyema, or the formation of adventitious cavities by long continued infection and consequent fibrosis. They may be necessary as a part of operative procedures for cosmetic purposes, as will be illustrated later.

No claim to originality can be made when considering the technique in these cases, but it may be worth while to bring to your attention certain cases presenting somewhat unusual opportunities for such procedures. It is sometimes forgotten that cure in patients with non-collapsible cavities can be secured only by respecting well-known surgical laws of repair of tissue. The walls of cavities must come in contact with one another or with other living tissue, or must be so close together that proliferating cells from their walls can ultimately meet. In the latter instance, it is well known that there is a limit to epithelial proliferation, because of the fibrosis which takes place wherever granulation tissue is formed. Just how large a cavity can be filled by the proliferation of epithelial cells cannot be stated in definite terms, since the vascularity of the part and other factors, such as the nature of the infection and the body resistance, must always be taken into consideration. Removal of the hard, unyielding, fibrous wall will permit greater growth from the underlying structures, and greater possibility of collapse if, as in the pleural cavity and cavities developing in soft tissues, the nature of the surrounding structures permits or favors such a procedure. At times such an operation may be impossible, as will be illustrated by the following reports.

Among the problems presenting themselves have been cavities in the skull, in the long bones, in the pleural cavity, in the abdomen, and in the soft parts. Where it is possible to secure collapse of the cavity by removal of the wall, this is the procedure of choice.

If simple measures fail, or if the nature of the structure is such as to prevent collapse, the transplantation of living tissue from the same individual, either in the form of free or pedicled transplants, will often be of the greatest benefit. In my service both forms have been used with success. Where possible the pedicled transplant should be used.

The use of free transplants has in my hands been restricted to transplants of fat. I have used fat transplants a number of times in porencephalic and osteomyelitic cavities. With the former type I have had no failures so far as I know. There has been no infection or loss of the fat, and I believe that the transplants have obliterated the cavities. Several patients suffering from convulsive and pressure symptoms seemed to be relieved. No deleterious consequences have been observed, but owing to the nature of the disease from which the patients suffered it would be unwise to claim brilliant results. With osteomyelitic cavities failure has generally followed the use of free fat transplants. It has seemed to me that this is due in large part to the poor blood supply of the walls of the cavity rather than to the infection present, because in only one case was the graft lost *in toto*. In almost all cases, however, the fat exuded in droplets during the succeeding weeks so that the transplants gradually disappeared. For this reason we ceased some years ago to use this method. The transplantation of free flaps of fat might succeed better in a decorticated pleural cavity, but other procedures have always seemed preferable, so that we have not attempted it in the treatment of empyema cavities.

In the transplantation of pedicled flaps of fat and subcutaneous tissue, of muscle, or of the two combined, we have a method that has been used for years with great success by all of us.

The following cases present some factors out of the ordinary and, owing to the difficulties

[1]Read before the Chicago Surgical Society, April 1920

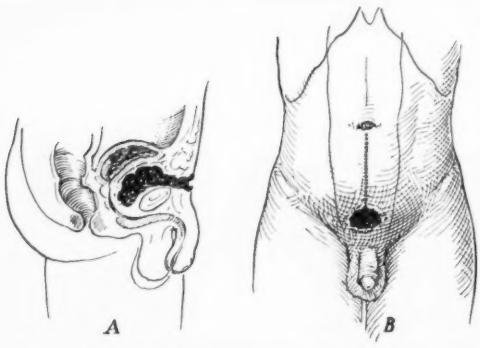

Fig. 1. Mr. E. V. Schematic drawing showing opening of sinus and position of cavity.

presented and the excellent results obtained, seem worthy of presentation.

Mr. E. V., Wesley Memorial Hospital, No. 78494.

For 5 years previous to operation this patient had an open sinus 1 inch above the symphysis pubis which was discharging more or less constantly. The discharge was purulent, and at times had a very offensive odor.

Ten years before entering the hospital, in jumping over a fence, the patient fell on the end of a rake handle, which entered the left groin and penetrated the abdomen. At the end of 3 months he had recovered from the immediate effects of the injury, but the wound in the groin was still unhealed. At the end of 9 months an abscess developed in the left gluteal region. After this abscess had been thoroughly drained the opening in the groin healed, but a new sinus developed in the gluteal region. About 6 months later the patient developed peritonitis, and was ill for 4 months. Three years later he suffered an inflammatory reaction over the entire lower part of the abdomen. He was taken to the Cook County Hospital where the old wound, which was still discharging, was excised and curetted. After operation the discharge increased for 4 or 5 weeks, following which the abscess was again opened and drained anteriorly, through a median incision 4 inches in length just above the symphysis. This wound healed in 6 weeks' time, though pus continued to discharge from the gluteal wound.

Six months later another abscess formed in the lower abdominal wall, which was opened. This continued to discharge until the patient came to us. The opening in the gluteal region had healed 2 or 3 months after his discharge from the hospital.

In addition to the symptoms mentioned, the patient suffered pain in the left leg below the knee This was especially evident when he was on his feet.

On examination the patient showed a large ventral hernia, and a small discharging sinus close to the mid-line just above the symphysis.

At operation, April 20, 1919, there was found an abcess cavity the size of a large orange in the space of Retzius, with thick fibrous walls so intimately united with the lateral walls of the pelvis, the anterior wall of the bladder and the urethra that excision of the wall of the cavity was deemed impossible. There was no tendency for the walls of the cavity to collapse.

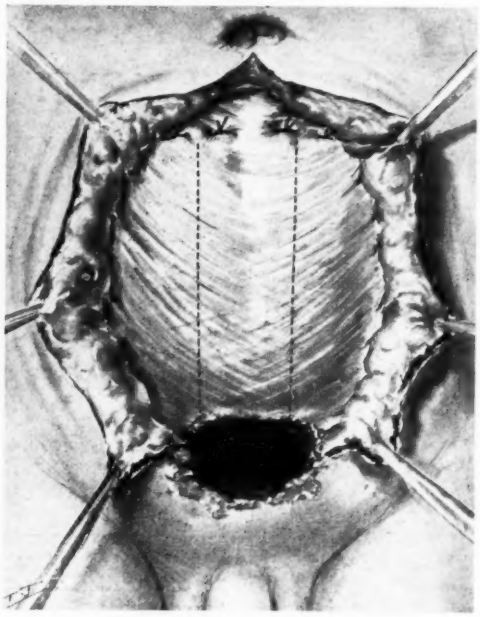

Fig. 2. Mr. E. V. Showing sinus and incision into the anterior sheath of the rectus.

An incision was made from the umbilicus to the symphysis pubis, and the orifice of the sinus was excised. The anterior sheaths of the recti were incised close to the median line, and both muscles exposed as high as the umbilicus. The recti were cut across at this point and the upper ends sutured to their sheaths so as to prevent retraction. A wide, pedicled flap of subcutaneous fat and fascia was also prepared. The walls of the cavity were curetted and the pedicled flaps of muscle and subcutaneous tissue turned in to obliterate it. The two cut edges of the sheaths of the recti were sutured in the median line; a strip of rubber glove was inserted for drainage; and the skin and fascia were closed by figure-of-eight sutures of silkworm-gut.

After operation the wound discharged for 3 weeks, during which time it was irrigated three times daily with Dakin's solution. At the end of this time the patient left the hospital with a small discharging sinus which closed completely in 3 weeks, and has not reopened. The patient has gained 30 pounds in weight and has had no trouble since. Examination 18 months after

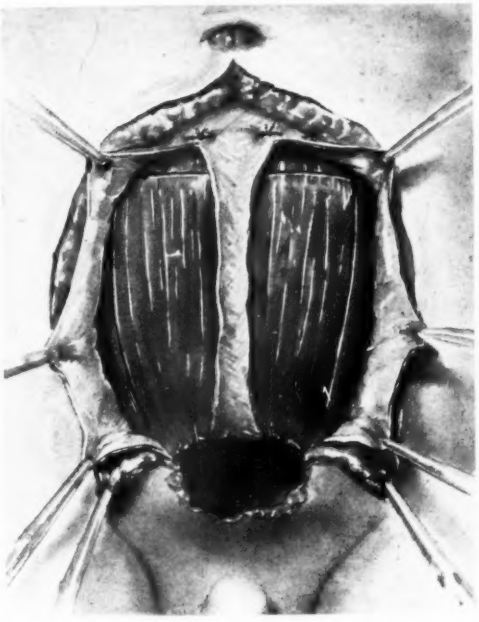

Fig. 3. Mr. E. V. Showing sutures holding upper part of rectus with incision into the recti for pedicled flaps.

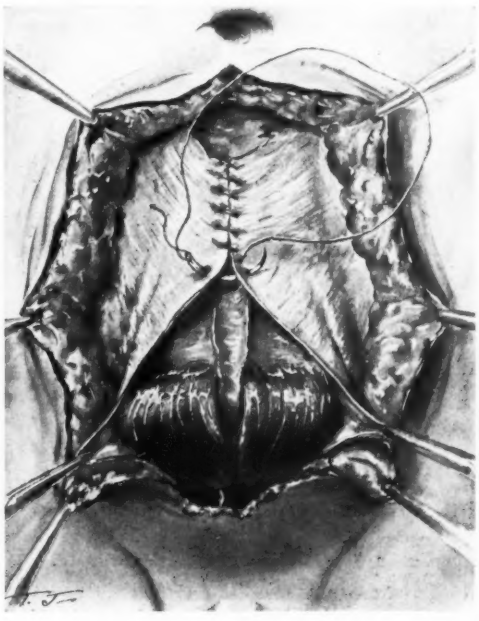

Fig. 4. Mr. E. V. Showing closure of anterior sheath of the recti after pedicled flaps had been put into cavity.

operation discloses a weak abdominal wall, with a diffuse bulging.

This patient had been operated upon by several able surgeons, and in spite of excellent surgical technique and care, the cavity was not obliterated. The intimate association of the walls of the cavity with the bladder and pelvic structures precluded the possibility of dissecting away its hard, fibrous walls and permitting it to collapse. The weakness of the abdominal wall, resulting from the operation, is in nowise comparable with the disability and distress occasioned by the constant purulent discharge and the constant absorption of retained toxins. The rapid restoration of the patient to perfect health fully justified the extensive operative procedure.

Mr. E. F., Wesley Memorial Hospital, No. 69537.

Three years ago, 2 weeks after operation for enlarged glands of the neck, this patient noticed a painless, non-inflammatory swelling of the forehead, which persisted for a years. At the end of that time the swelling broke down, leaving a deep ulcer whose base involved the frontal sinus. The ulcer healed under antisyphilitic treatment, leaving a deep unsightly excavation over the forehead.

On examination the patient showed a healed depression of the forehead about 1 by 2 inches in its lateral dimensions, and 3 inches in depth, involving the frontal sinus of the left side. There was a small bridge of skin running across the center of the area. The bone at the base of the depression was covered by granulation tissue.

At operation the edges of the skin were freshened and the bridge of skin removed. A flap of

Fig. 5. Mr. E. V. Two years after operation.

Fig. 6. Mr. E. F. Showing transplant of pedicled skin and fat healed in frontal sinus 4 weeks after operation.

hairless skin with its pedicle was outlined on the left forearm and the incision extended downward from the lower end of the flap for a distance of 2 inches, so as to permit securing an additional area of subcutaneous fat and fascia as large as the flap itself; in other words, the subcutaneous portion of the flap was twice as long and of the same width as the cutaneous portion. The forearm was carried to the forehead, and that portion of the flap consisting of fat and subcutaneous tissue doubled under the first portion so as to fill the excavation in the bone. The edges of the skin were attached to the skin of the forehead, and the arm held in position by a plaster-of-Paris bandage. In the course of the next 20 days the pedicle of the flap was partially severed at intervals of several days and finally completely detached, after which the remaining free edge was attached to the skin of the forehead.

No nasal trouble nor sinus infection followed the operation. A small edge of the skin flap sloughed, leaving a scar after healing one-fourth inch wide at one edge. The skin of the flap remained on a level with the surrounding tissues. After the excision of the small linear scar and reunion of the edges, the result will be perfect from a cosmetic standpoint.

This patient had a syphilitic osteomyelitis, with such an extensive excavation because of the depth of the frontal sinus that had skin alone been used to cover it the result would still have been most unsightly. With the double flap the defect was

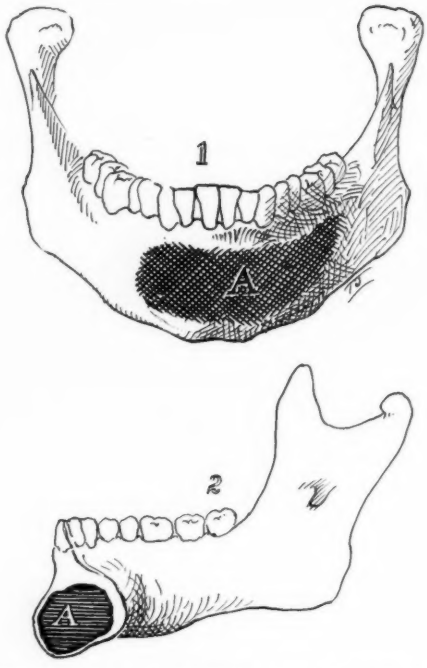

Fig. 7. Mr. A. B. Schematic drawing showing size and position of cyst in the mandible.

filled, with the result that 3 years after operation the skin was still on a level with the surrounding tissue. The small scar seen along the edge had flattened out considerably and was so little noticeable that the patient declined to have this excised and the edges of the skin brought together. Except for this, the result was perfect.

Mr. A. B., Wesley Memorial Hospital, No. 88839.

Twenty years ago this patient began to have trouble with his teeth, particularly with those on the left side of the mandible. They were extracted, one by one, until only the incisors were left on this side.

Fourteen years ago a swelling, which at first was soft and compressible, appeared on the left side of the chin; the application of pressure over the swelling produced a discharge of bloody fluid in the mouth. The swelling was lanced six times during a period of 6 months, with no result except the appearance of a bloody discharge. At the end of that time the mass, which except for one small area had gradually become indurated, was removed with apparent success.

Nineteen months ago a hard and brawny swelling reappeared and increased in size for 2 months. Thereafter it remained stationary in size, but gradually became so painful that for 2 months previous to admission the patient was unable to sleep at night. During the latter period the mass seemed to become softer in consistency. There was no history of fever or chills at any time.

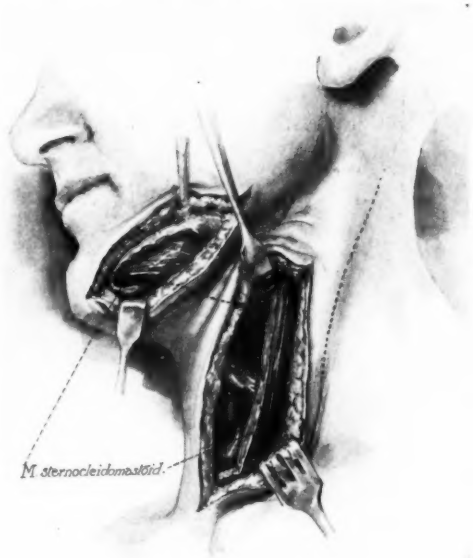

Fig. 8. Mr. A. B. Showing technique of obliteration of cavity in the left side of mandible.

There was nothing of interest in his past record except for the history of a fall on the chin at the age of 5 years. He had had no venereal infection. He had not lost weight.

The physical examination was negative, except for an assymetry of the face, due to the presence of a tumor mass which involved the left side of the mandible in its anterior half. This mass was about the size of an egg, was hard and brawny, with the exception of a small fluctuating area about the size of a hazelnut. The mass was fixed, seemed a part of the jaw, and extended into the floor of the mouth on the left side. The skin over the mass was movable and not inflamed. There was moderate tenderness present on pressure. There were no palpable submaxillary or cervical lymph glands on the left side. There was a scar, 4 centimeters long, along the ramus of the mandible on the left side. The patient's leucocyte count was 14,500. The coagulation time of the blood was 3 minutes. Urine examination showed no abnormal findings.

At operation there was found a cyst of the mandible extending from the first molar of the left side to the first bicuspid of the right side. This cyst was limited by a definite wall and was filled with glairy mucus and fibrous tissue. The posterior portion showed no bony wall externally, but the anterior portion close to the symphysis had a thin, parchment-like covering of bone anteriorly. The inner and posterior wall was formed of the corresponding thick cortical layer of the mandible. The cavity was the size of a large thumb. The symphysis had bulged forward slightly so that there was some prominence of the chin. It was evident that the inner wall was sufficiently strong to support the jaw, so that no bone transplant was necessary, but that if the anterior wall were destroyed, considerable deformity on the left and in front would result. No teeth were found in the cavity.

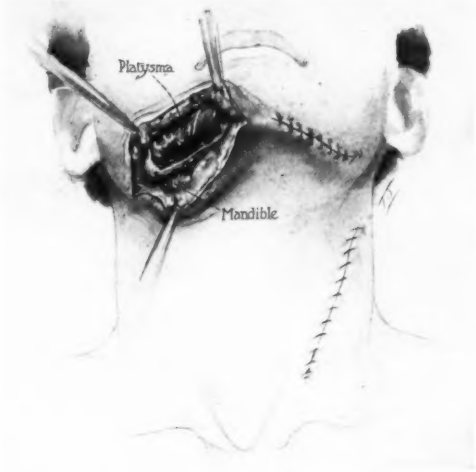

Fig. 9. Mr. A. B. Showing obliteration of cavity on right side of mandible.

An incision was made under the left side of the mandible, the skin dissected upward, and the contents of the bony cavity with its lining removed. To fill the resulting cavity with living tissue a pedicled flap was prepared from the left sternocleidomastoid muscle, by using the sternal and a part of the clavicular portion, freeing it from the sternum, and swinging it upward and inward under the skin and deep fascia close to the angle of the jaw so as to insert it into the cavity in the mandible. Since the end of this

Fig. 10. Mr. A. B. Photograph taken 10 days after operation.

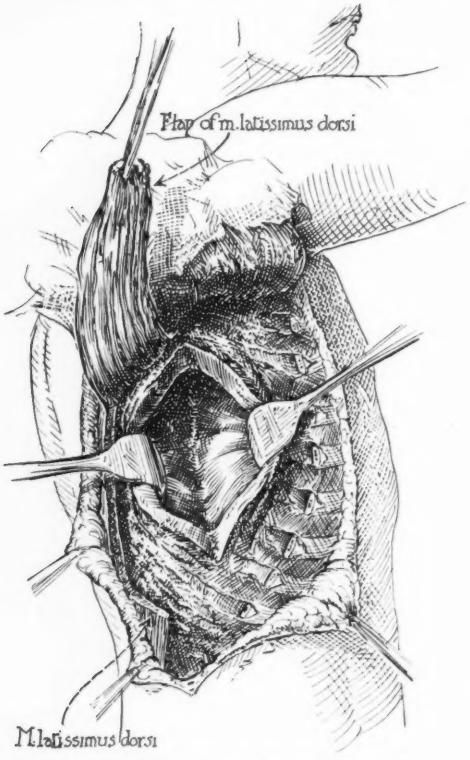

Fig. 11. Obliteration of old empyema cavity.

flap would reach only to the symphysis, a second incision was made upon the right side under the mandible, and a flap of platysma muscle with the overlying fat and fascia raised from underneath the chin and turned forward into the remaining space through an opening in the thin shell of bone which formed the anterior wall of the mandible in that position. The wound was closed without drainage.

The wounds healed by primary union, and the patient was discharged in 10 days, apparently completely recovered.

Had the anterior wall of the cavity been broken into so as to produce obliteration in this case, or had it been removed so as to permit the soft tissues to fall in and obliterate the cavity, a most unsightly deformity would have resulted. By the method used the contour of the jaw was maintained. Sufficient time has not elapsed to report on bone formation, but the operation appears to have been successful in every way.

Pedicled flaps in the pleural cavity have been used with perfect success. I have already reported the first case in which I used this. (C. B., operated upon at Cook County Hospital, No. 594895.) Since that time I have had occasion to supplement thoracotomy by pedicled flaps in several instances, and always with perfect satisfaction.

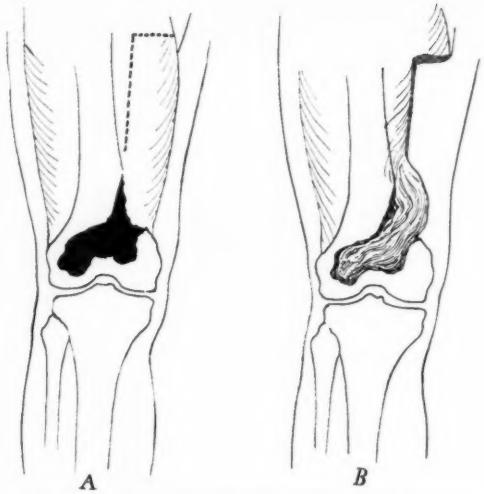

Fig. 12. Mr. R. S. Showing obliteration of cavity filling entire lower end of femur.

With old osteomyelitic cavities, it is a *sine qua non* that they should be obliterated either by removal of the walls and overhanging bone, so that the surrounding soft parts can come in contact with the bone throughout; or by a pedicled transplant of muscle, fat, or skin laid into the depth of the cavity in such a way as to produce obliteration. This I have done many times with success. These cases are usually not difficult, since they ordinarily involve the shaft of the bone. One patient, however, presented a particularly interesting problem because of the presence of a cavity in the lower end of the femur, involving practically the entire head of the bone down to the articular surface. If one had attempted to remove the walls, the joint would certainly have been destroyed. The detailed history of this case is as follows:

R. S., Wesley Memorial Hospital, No. 36862.

This patient had suffered from a discharging sinus on the inner side of the left femur at its lower end for over 2 years. Three attempts had been made to cure it. At the first operation, during the acute stage, the thigh was incised and drained. At the second operation the sinus was curetted and a sequestrum removed. At the third operation the wall of the osteomyelitic cavity was partially removed, and the operation was followed by antiseptic treatment.

When he came to us there was a large sinus on the inner aspect of the thigh, leading down into the lower end of the femur. X-ray examination showed a cavity involving the lower end of the femur, and separated by only a thin wall from the knee-joint. General examination showed nothing of importance.

At operation the cavity was opened by a longitudinal incision at the medial side of the quadriceps extensor. No dead bone was found. The cavity, which occupied the entire lower end of the femur, was curetted and its overhanging edges removed. A flap of muscle taken from the edge of the quadriceps extensor with its base downward was turned into the cavity so as to obliterate it. The skin was sutured with catgut, and a rubber tube for the instillation of antiseptic solution was inserted.

There was considerable discharge for 2 weeks after operation, and a slight discharge for 10 weeks. After three injections of bismuth paste, the wound healed completely and remained closed. The patient was discharged in 4 weeks, being cautioned to be careful in using his legs for the next year. He reported 4 years after operation that he had had no trouble, and that he had taken part in track athletics and basket ball with no injurious results.

AN ADJUSTABLE EXTENSION AND SUSPENSION "BALKAN" FRAME

By NATHANIEL ALLISON, M.D., F.A.C.S., St. Louis
Professor of Clinical Orthopedic Surgery, Washington University School of Medicine

THE appliance here described is not new in any of its principles. It represents a device used with unusual success during the war in our military hospitals. The details are clear from the illustrations. It is made of ordinary $1\frac{1}{16}$-inch tubing and can be adjusted to any type of hospital bed, 2 feet 6 inches in width and 6 feet 6 inches in length.

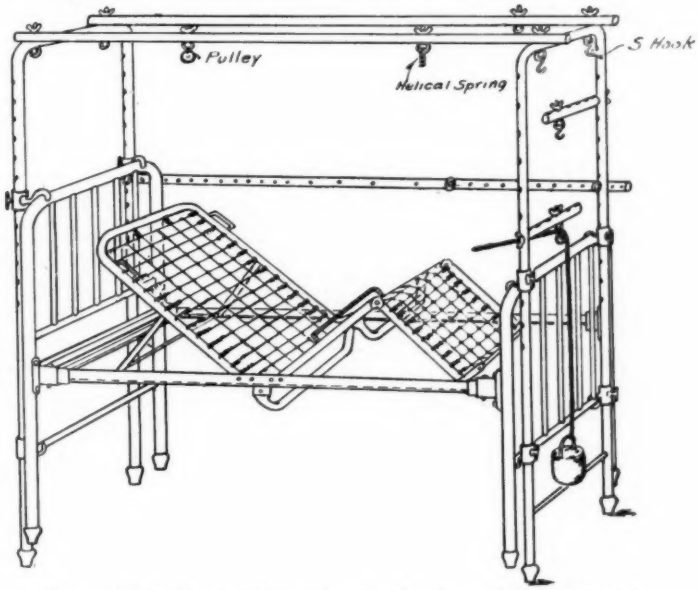

Fig. 2. Adjustable extension and suspension frame for treatment of fractures and joint injuries. Height of frame 6 feet 6 inches from floor, 2 feet 6 inches wide. Made of $1\frac{1}{16}$-inch tubing, with rubber covered adjustable malleable iron hooks and wood plugs, two long top bars, one long side bar two short foot bars drilled so that any sort of adjustment can be made.

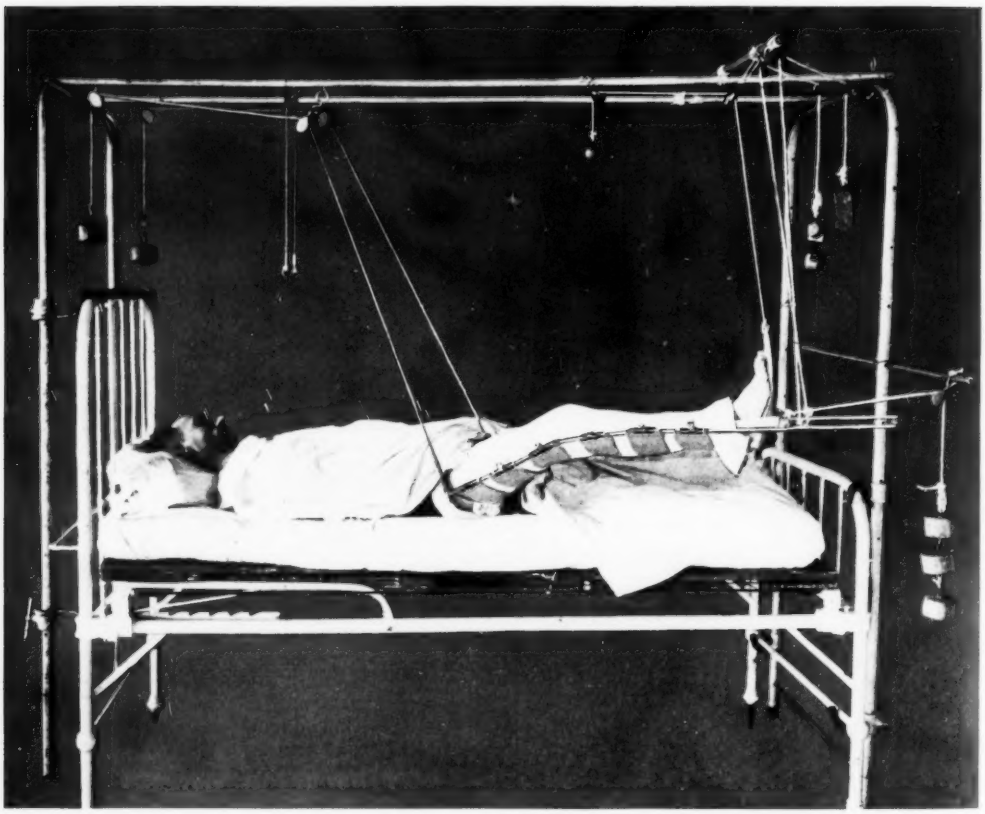

Fig. 1. Photograph showing frame in use.

It is described for the following reasons:

To emphasize the value of the suspension treatment of fractures and joint injuries in our civil hospitals;

To interest others in having available in our hospitals for immediate use a frame made of tube which will not present the disorderly appearance of the wooden Balkan frame which is used at the present time in our civil hospital wards.

The frame possesses greater rigidity than the wooden frame.

It is not expensive, and adjustment is more easily and perfectly carried out.

TREATMENT OF LONG STANDING DISLOCATIONS OF THE HIP

By J. SCHOEMAKER, M.D., The Hague, Holland

In January, 1902, a young woman consulted me in regard to a limp which had been growing worse, more painful, and fatiguing. I had known for some time that the patient had a dislocation of the right hip. Two years ago I had operated upon her to correct a right femoral hernia.

At the age of 10, 13 years ago, the patient was extremely ill but she remembers only that at that time she had a high fever and that her illness may have been typhoid. After her recovery she limped although before this she had walked normally. The lameness grew worse and worse and she was advised to wear a thick sole on the right shoe. Even with this she did not like to walk and finally could walk a distance of but a half mile when she suffered much pain in the gluteal region. The right leg was in normal position and could be moved in all directions. The muscles were not so fully developed as on the left side. The shortening was 6 centimeters. The top of the trochanter was 6 centimeters above Nélaton's line. It follows, therefore, that the bones of this extremity were normal. A line drawn tangentially from the top of the great trochanter along the anterior superior spine of the ilium and extended up to the middle line reached the mid-line at the symphysis; on the opposite side the intersection was at the umbilicus. (This line which I have named the trochanter-spina line was described in the *Zeitschrift fuer Orthopædie und Chirurgie*, vol. xix, is very valuable in indicating displacements of the great trochanter.)

X-ray examination revealed a dorsal dislocation of the femur, the head and neck of which appeared fully developed. In the presence of these findings I could not resist attempting to reduce the dislocation. It was doubtful whether this could be accomplished for (1) the soft parts were so short difficulties might be encountered especially with the long thigh muscles; (2) the capsule might be too narrow; and (3) the acetabulum might be filled with tissue. It is a well known fact that soon after dislocation the acetabulum is often filled with fibrous tissue from the capsule and the torn ligamentum teres.

The following technique was used: First we planned to reduce the dislocation after powerful extension. If this failed we planned to expose the joint, incise the capsule, clear the acetabulum, and then try to replace the head of the femur. If this proved to be impossible, we planned to shorten the femur, but this step was to be employed only as a last resort. We proceeded as follows: The leg was held in extension by means of a 6 kilogram weight. After a fortnight the patient was anæsthetized and a Lorenz traction apparatus applied. This produced such effectual extension that the level of the trochanter was considerably owered. The traction apparatus was then loosened, the femur flexed as far as possible and, with the head of the femur attached to the pelvis, strong abduction was made to stretch the adductors very forcibly. After this the limb was extended again to repeat this extension. In other words, we used an imitation of Lorenz' method of reducing congenital dislocation of the hip. The manœuvre was crowned with success. When at last the knee was flexed and the limb lay parallel with the chest, the trochanter was directed straight downward and all the long muscles of the thigh acted in the same direction. In this way the head of the femur was pulled downward. We next abducted very strongly so that the knee was pressed flat on the table. The head of the femur thus passed to the front. Thus we brought the head of the femur in position on the pelvis in the supposed position of the acetabulum. We did not feel the jump of a reduction, but in bringing the limb toward the middle line the head slipped over a ridge with a palpable tug and flew back to the original dislocation position. The head had been placed under a bony wall, which stopped the reduction, probably the limbus of the acetabulum. This reduction manœuvre was repeated and although there was no perceptible jump a plaster-of-Paris splint was applied with the limb strongly abducted and the knee lying upon the table. Palpation showed the head of the bone below the iliac spine. We were convinced that reduction had not been accomplished but the head of the femur lay just over the acetabulum. We supposed the displaced capsule and the tissue in the acetabulum prevented reduction but hoped ultimately to bring about reduction by the continuous pressure of the head of the femur. Another chance was that the dorsal dislocation might be transformed into a pubic dislocation. The patient complained of violent pain at the inside of the knee on recovering from the anæsthetic. She indicated exactly the place which is pointed out in cases of early inflammation of the hip-joint. From this we concluded that the capsule was pressed tightly. It was not possible to secure an X-ray picture until 6 weeks later at which time the head appeared to be entirely inside the

Fig. 1. Case 2, position of the head in dislocation.

Fig. 2. Case 2, head resting on acetabulum.

Fig. 3. Case 2, head inside acetabulum.

acetabulum. The reduction had succeeded! The patient was again placed in a plaster-of-Paris cast, but the limb was not so strongly abducted as before. She could walk on it very well at this time. After 6 weeks this second plaster cast was taken off and the hip was found to be normal and the patient walked without a limp.

CASE 2. A man, age 61, was knocked down by a motor car. He was brought to the hospital on December 3, 1919, nearly senseless. An immediate diagnosis was made of dislocation of the hip on both sides; on the left side an obturator dislocation and on the right side a dorsal luxation. The diagnosis was confirmed by X-rays. The dislocation of the left side was reduced by the house surgeon, Dr. Huese, without any difficulty, but it was not possible to reduce the right dislocation. The next day I examined the patient myself. The left hip was normal. On the right side the trochanter was 4 centimeters above Nélaton's line, the trochanter-spina line met the middle line 2 fingers' breadth above the symphysis, on the left side one finger's breadth above the umbilicus. The limb was rotated slightly inward and abducted a little but was not flexed. The leg could be flexed to 45 degrees and abducted about 30 degrees. In studying the X-ray plate the radiologist noticed that the acetabulum seemed a little flat, so he questioned whether it might not be a congenital dislocation. In the presence of a normal head and neck, congenital dislocation seemed doubtful; on the other hand the position was not very characteristic of a traumatic dislocation, nor was the fact that the limb could be moved without producing pain. When we asked the man, whether the hip was the same as before the accident he did not give a decided answer but said he thought it was. I did not agree with him. I tried to reduce the hip under an anæsthetic, but was unsuccessful. When the patient recovered from the anæsthetic he declared he would not be treated any further; the hip always had been just as it now was and he could walk very well. Three days later he trained himself to walk. He soon walked fairly well and after a fortnight he left the hospital. He was a little crippled but had no pain. Six weeks later I heard that the lameness had grown worse and that he soon became tired and suffered pain. His wife told me that he had never before been as he is now and that before being hurt his gait was quite normal; his foreman too answered affirmatively, whereupon I advised the man to come back to the hospital as soon as possible. He did so on February 16, 1920. He then told us that his present condition was quite different from what it had been before injury and that he attributed the condition to the accident. Meanwhile it had become a dislocation of long standing because 2 months had elapsed and according to all investigators a dislocation of the hip is considered as of long standing after 6 weeks. Notwithstanding this we left nothing undone to obtain reduction. On February 21, the man was anæsthetized and the limb flexed and abducted as in the previous case. Preliminary traction was not employed because at the present time not much faith is placed in it in the treatment of congenital dislocations. We flexed the leg continuously until we brought the knee to the chest and then we abducted as far as possible. At last we got the limb in a position at right angles to the axis of the trunk and almost to the level of the table. The whole manœuvre took about half an hour and was done without much force. We did not observe a reduction jump or click. The limb was put in plaster of Paris in this position and the patient made no definite complaints on recovering from the anæsthetic. The next day, X-ray examination showed the head of the femur resting on the acetabulum. Fifteen days later the plaster cast was taken off and abduction diminished. Clinically it was obvious that the hip was reduced and this was confirmed by the X-ray plate. Figures 1, 2, and 3 show the position of the head in dislocation, resting on the acetabulum, and inside the acetabulum, respectively.

A new plaster cast was not put on, the patient was allowed to diminish, little by little, the abducted position of the leg. After 4 days the leg lay extended and could be moved very well both actively and passively. Then he trained himself to walk and on March 24 he left the hospital, walking normally.

In these two cases we have reduced dislocations which might fairly be called long standing dislocations. A report of the first case was published in 1902 in the *Deutsche Zeitschrift fuer Chirurgie*, lxvi, but at that time I felt that it was too early to state definitely that this treatment might be looked upon as the method of choice. In 1903, Goldmann, *Deutsche Zeitschrift fuer Chirurgie*, lxvi, reached practically the same conclusion, and quoted the case I published. He reduced a perineal dislocation 84 days after injury. At the time of examination the roentgenograms showed that the head of the femur lay on the acetabulum but was not entirely inside it, due to the presence of fibrous tissue. Six weeks afterward another X-ray showed clearly that the head of the femur lay quite inside the acetabulum and there was no visible intervening space. Because the possibility of bringing the head of the bone into the acetabulum was so well proved by these two cases, Goldmann proposed that reduction should be tried in all cases of long standing dislocation. When this means of reducing the dislocation is not successful, or even partly successful, he suggests doing a transposition (as suggested by Lorenz and Codivilla). In reducing a dislocation forward, the head rests on the pubis and a nearthrosis is formed. Lorenz[1] did such a transposition in 1907 and was well satisfied with it. Notwithstanding, the method was not generally accepted, the prevailing opinion being that an operation is necessary when a dislocation cannot be reduced in the usual way. I question this: The advocates for operation, as Payr,[2] Dollinger[3] and Buchanan[4] argue that bloodless reduction is more dangerous than the operative method because the femur may be broken at the neck or shaft, muscles may be ruptured, or there may be a great deal of shock. I believe we need not reduce the dislocation so roughly as to fracture the bones or rupture the muscles. I grant that Lorenz's description sounds rather terrifying. In a man 34 years of age, an assistant had tried to reduce the dislocation but in vain and Lorenz performed a transposition. The shock was very severe and even alarming during the first and

[1] Orthop. Congress, 1908.
[2] Deutsche Ztschr. f. Chir., liv.
[3] Ergebn. d. Chir. u. Orthop., iii.
[4] Surg., Gynec. & Obst., xxxi.

second day. All possible efforts were made to overcome this. The scrotum, the thigh and the abdomen were swollen so that the plaster had to be taken off on the day after operation. The patient recovered and left the hospital with external rotation and a thick sole in his boot. A roentgenogram showed that the head of the femur was in front of the acetabulum.

It is true also that operative reduction is not accomplished without difficulty. Payr states that in a case of irreducible dorsal dislocation of the hip of 4 weeks' duration such force was used in producing extension that the head of the femur was brought to the acetabulum but it slipped off. Operative reduction was then performed. This was obviously very difficult and required the greatest effort. The man died the same evening. The postmortem examination showed bleeding into the psoas muscle and rupture of the adductors.

We should modify our technique according to conditions found. When there is an old dislocation and the roentgenogram shows normal proportion between the head and acetabulum, we may try reducing the dislocation in the usual way. As a rule this fails, and yet there is no indication for open reduction not even for a transposition. The head must be brought to the entrance of the acetabulum with the limb placed in complete abduction after complete flexion. The thigh must be at right angles to the axis of the body, on a level with the symphysis. This position can be attained only with the patient in deep narcosis. With the patient on his back, the sound limb is held fixed by an assistant. The injured leg is seized by the knee and the foot and is flexed as far as possible without much force. The knee must then be drawn outward and the limb abducted. The leg is afterward extended a little and brought back to the middle line. In this way a horizontal circle is described and the starting point is reached. This movement is repeated several times, and on each occasion a larger circle is made. With every movement of flexion the head of the femur passes downward and with every movement of abduction it comes to the front. A circle is thus made which is so large that on flexing the knee, the femur is parallel with the body and on abducting the femur it is at right angles to the axis of the body. The head of the femur then lies in front of the acetabulum and it is fixed in this position in plaster of Paris. The following day a roentgenogram is taken to show whether the head lies in correct position in front of the acetabulum and if it does the plaster is kept on for a fortnight, at which time the cast is taken off and the patient is allowed to bring the leg back into the normal position. This is accomplished slowly as the muscles have become accustomed to the abnormal position. The result is again controlled by roentgenograms and if the head of the bone is really inside the acetabulum the patient should be encouraged to walk.

I believe this method should be used in all dislocations of long standing and in irreducible dislocations of the hip. The only danger is that an anæsthetic must be used. Ruptures and fractures need not occur for all manipulation should be practiced with moderate force. If reduction is not successful at once, it may be accomplished in two stages. Success was immediate in the only two cases I have treated so it should not fail in other cases. Both were backward dislocations. In irreducible obturator or sciatic dislocation I should try in the first place to convert them into dorsal dislocations and then reduce them against the entrance of the acetabulum.

A NEW PROCEDURE IN THE TREATMENT OF ECLAMPSIA

By H. J. DAVIDSON, M.D., Seattle, Washington

I HEREIN present a new procedure in the treatment of eclampsia which I have used with gratifying results in eleven cases. In making this preliminary statement it is my earnest desire that application may be made by other observers, the better to establish its value.

Of the universally accepted procedures I have discarded excessive bed clothing and heat applications in their several varieties for the purpose of inducing perspiration, and substitute therefor the following:

The stomach tube is passed every four hours, for the purpose of leaving from a liter to a liter and a half of water in the stomach. If this simple procedure is adhered to the patient will soon begin to perspire with surprising copiousness without application of heat, and without being weighted down with excessive bed coverings.

Several questions naturally present themselves as possible objections.

The patients are usually unconscious and some object to tubing such cases. The ordinary precaution as to determining that the tube is in the stomach and not in the trachea, meets that objection. Regurgitation and aspiration, as far as my observations go, need not be feared. A remarkable flatulency and general atonic condition usually prevail. The large amount of water introduced seldom produces regurgitation. The water may be introduced fairly rapidly and the tube quickly removed if regurgitation retching intervenes. The marked flatulence and apparent atonic state of the gastro-intestinal canal might suggest acute gastric dilatation into which it would be inadvisable to introduce large quantities of liquid. My observations lead me to believe no anxiety need be felt as to that condition. That the stomach empties itself is established by the fact that in no instance have I ever recovered any portion of the water introduced four hours previously, although I have often left in well over one and a half liters.

As to the soundness of the judgment upon which this treatment is based, I submit the following suggestions:

We are dealing with a toxic kidney block, rather than a true nephritis. The amount of urine the kidneys can secrete as soon as the block is broken is truly surprising. Indeed it is limited only by the amount of ingested fluids.

It is a recognized fact that fluids introduced through the stomach are excreted by the kidneys more rapidly than if introduced into the rectum, into the tissues by hypodermoclysis, or even intravenously. I have recovered by catheterization as little as two ounces of urine for the eight-hour period at the beginning of treatment, and in the next succeeding eight-hour period, thirty-two ounces, and a total of over one hundred and twenty ounces in the first twenty-four hours of return of renal function.

Epsom salts in ounce or ounce and a half dose should be given once or twice in the 24 hours, and some alkali, as 20 grains of potassium acetate and citrate mixture, each time the tube is passed. The bowels usually move copiously without the use of more drastic catharsis.

Initial control of the convulsions by large doses of morphine hypodermatically, spinal puncture if the eye grounds indicate it, combating flatulence by means of esserin, pituitrin, hot stupes and enemata, and cardiac stimulation should not be neglected. I have not resorted to initial bleeding even in cases of extreme œdema.

The benefits as I have observed them are numerous. Gavage every four hours is far more simple than repeated hot packs, and can be done in the home where efficient hot packs are impossible. The debilitating effect of the hot pack on the heart is avoided. A far larger amount of fluid is introduced into the body than can be done by any of the customary methods. The large volume of fluid introduced probably stimulates natural peristalsis, and aids in accomplishing efficient evacuation, without necessitating resort to the drastic cathartics. And I believe the desired therapeutic result is more promptly and more efficiently achieved.

As a final admonition I would urge that in severe cases at least three gavages be performed after the patient is considered well out of the critical state, to insure against recurrence of convulsions and consequent disappointment as to the value of the procedure.

GASTRO-INTESTINAL SUTURING FORCEPS

By RAFE C. CHAFFIN, M.D., Los Angeles, California

MANY methods and devices have been used to facilitate the Connell suture in gastro-intestinal surgery. The best instrument I have seen for this use is the Judd forceps, and the accompanying cut shows a modification of that forceps by which it is given many advantages. Neither the skilled surgeon nor the occasional operator need have any special experience in using this instrument to take advantage of its many good points. Figure 1 shows the open forceps and Fig. 2 *a* and *b* illustrates the technique of its application.

Anastomosis is carried out in the usual manner until the posterior mucosal suture is completed. With the suture emerging from the serosa at the angle of the gut opening, the forceps are held in the left hand with the handle pointing toward the elbow. The single tooth is inserted under the mucosa within the lumen of the bowel close to

Fig. 1. Author's gastro-intestinal suturing forceps.

the point at which the last suture emerges. The forceps are closed and the single tooth elevates an area of tissue under which the needle is passed pointing toward the operator (Fig. 2*a*).

The next manœuvre is to withdraw the tooth of the forceps and by rotating the hand slightly the opposite single tooth is inserted on the opposite side (Fig. 2*b*).

This is continued, alternating with the two sides, until the opening is closed. The assistant holds the thread taut each time while the operator is inserting the needle.

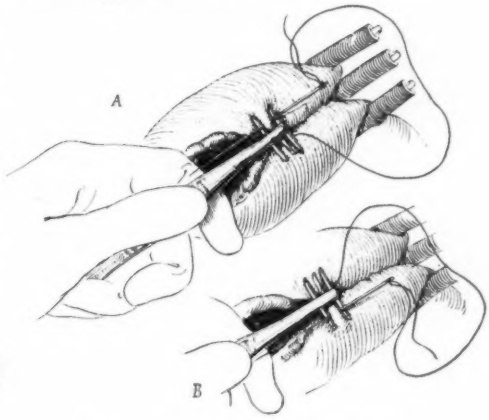

Fig. 2. *a* and *b*. Application of forceps.

ADVANTAGES

1. Accurate spacing of all stitches;
2. All stitches grasp all layers, thereby minimizing hæmorrhage;
3. Rapid closing because of minimum amount of motions necessary;
4. Least amount of soiling of field.

BOOK REVIEWS

A CRITIQUE OF NEW BOOKS IN SURGERY

PERHAPS one of the most important contributions to the field of surgery as a result of the recent war, has been the focusing of attention upon injuries of the peripheral nerves. Not common in civil life, they heretofore had passed unobserved. The work[1] under consideration is a material example of this importance. Written in an interesting and logical manner, the authors have crystallized the plethora of material on this subject into a pleasing and compact volume.

The real object of the treatment of peripheral nerve injuries is restoration of function by the most logical method of direct nerve suture. Restoration of complete function is perhaps the pinnacle of success to be reached in only a limited number of cases. Return of function of the simpler actions is a common result but the return of those finely co-ordinated movements which require years of training to develop, does not offer a particularly promising prognosis. To attain this end, however, should always be the objective and it is interesting to note the emphasis given to several points in the treatment followed by the writers. There seems no more room for doubt concerning the fact that the living primitive sheath must be present to expect recovery, which must always be a matter of months. The insistence upon a pre-operative preparatory treatment of massage for secondary deformities and atrophies is a matter of no little import. The suturing of the nerve ends does not complete the treatment. Postoperative passive and active movements and electrical treatments are continued until recovery is assured.

The differentiation between complete and incomplete anatomical lesions is a difficult one. A question arises as to whether or not any given group of signs or symptoms suffices. The marked atrophy of an incomplete ulnar lesion and the pronounced paralysis of a similar radial lesion are cases in point. The clinical course is of much more importance in making a diagnosis.

The diagnosis of regeneration and recovery used by the authors follows closely those principles laid down by Head and his co-workers. Recently, some question has been raised as to the reliability of all of those signs. It is a debatable point whether or not protopathic sensibility occurs before epicritic sensation in an area free from the influence of overlap.

The importance which the surgery of the sympathetic system is assuming is hinted at by the authors' suggestion that the causalgias resulting from an irritant incomplete lesion may depend upon injury to the sympathetic fibers carried in the main trunks along with fibers serving motion and sensation.

The chapters dealing with the operative technique emphasize the value of various resections and dislocations necessary to obtain a direct nerve suture. The use of Cargile membrane, hardened animal veins, and other materials to protect the line of suture have been discarded for the simpler protection afforded by a muscular bed.

This little volume represents one of those rare works which give us the meat of the subject in a manner which makes it a work of art. L. E. DAVIS.

IN this illustrated work[1] the author reviews the subject of fractures of the neck of the femur, including the etiology, bony architecture, and blood supply of the neck, pathological anatomy, the course of bony union, the symptoms and diagnosis, and the various common methods of treatment, both by open operation and other means. Delbet's classification of true cervical fractures (recent), cervicotrochanteric or intertrochanteric, and pseudarthroses is advanced leading up to his method of treatment for these conditions. The treatment offered was first undertaken as routine in 1914 and the present report is based on 128 cases.

Arthrotomy of the hip-joint is not employed because of the seriousness of the operation and fear of possible interference with blood supply of the femoral head. For fresh true cervical fractures he uses an American screw 7 to 9 centimeters long, driven from a point 1 centimeter below the greater trochanter of the femur through the shaft into the head. Local anæsthesia is required for metal screws, general anæsthesia for bone transplants. The incision is 5 inches long over the trochanter of the femur. The legs are completely extended, the injured leg being pulled down by mechanical traction, and the great toes tied together, with the feet straight up. The injured limb does not lie in abduction or inversion. By means of his special metal guide which is placed beneath the patient's hip and in correct relation to the head of the femur (which has been localized and marked by fluoroscopic ex-

[1] INJURIES OF THE PERIPHERAL NERVES. By Henry S. Souttar, C.B.E., F.R.C.S.(Eng.), M.Ch. (Oxon.), Major, Ex-R.A.M.C., and Edward W. Twining, M.R.C.S., L.R.C.P. (Lond.), Capt., Ex-R.A.M.C. New York: William Wood Company, 1920.

[1] ANNALES DE LA CLINIQUE CHIRURGICALE DU PROFESSEUR PIERRE DELBET. No. 7. Fractures du Col du Fémur. By Antoine Basset. Paris: Felix Alcan, 1920.

amination, with the leg under 15 kilos of traction), the exact angle the screw must take to enter the head is fixed. It cannot go too far into the pelvis nor can it miss the head. This screw is threaded but one-half its length and although its function is transitory, it maintains co-aptation, reduces the fragments, causing pressure between them, and leads to bony union. This metal screw has been tolerated as long as 4 years. Four patients out of 31 died, 3 required secondary operation of 26 true cervical fractures so treated, in 2 the results were unknown; all others gave good functional results—one a bony union in 40 days. For cervicotrochanteric fractures the screw is not employed because bony union invariably results. Delbet's ambulatory splint is used for these patients except for very fat individuals or old females, for whom the screw is used.

For the pseudarthrosis he urges a strong bony transplant of fibula completely denuded of periosteum to open all haversian canals to revascularization. In 24 such cases there were 2 deaths. Twelve patients followed for 1 year gave promise of further improvement and in 7 cases followed from one to 6½ years the results were very satisfactory. Three cases gave excellent results. All operations were performed without arthrotomy or freshening of the bone fracture surfaces. No plaster-of-Paris casts were needed after operation. Out of 44 screw operations and 24 bone-grafts, he has had but 6 failures. In some instances his ambulatory splint apparatus is applied at the time of operation, but more often the feet are left simply tied together. Patients who have had a screw inserted, wear the apparatus 36 days; those who have had bone-grafts inserted wear the apparatus 45 to 60 days, using crutches in the meantime.

Four days after all operations passive motion and massage are started, patients are made to get up and walk as soon as possible. After fresh cervical fracture when wearing the ambulatory splint they get up in from 3 to 13 days; without the splint in from 12 to 30 days. After bone-graft operations, when wearing the ambulatory splint they are got up out of bed in from 10 to 40 days and without the splint in 2 to 60 days. They use crutches but are instructed *to walk correctly* and are made to use a cane as soon as they gain confidence.

American readers will be greatly interested in obtaining Delbet's personal technique and seeing his results, because his exactness of procedure coupled with a minimum of immobilization and bed confinement will appeal to all. KELLOGG SPEED.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

AMERICAN RED CROSS WORK AMONG THE FRENCH PEOPLE. By Fisher Ames, Jr. New York: The Macmillan Company, 1921.

THE AMERICAN YEAR-BOOK OF ANESTHESIA AND ANALGESIA. 1917-1918 edition. Edited by F. H. McMechan, M.D. New York: Surgery Publishing Co., 1920.

THE DISEASES OF THE NEWBORN. By Dr. August Ritter von Reuss. New York: William Wood & Company, 1921.

SURGERY, ITS PRINCIPLES AND PRACTICE. By Various Authors. Edited by William Williams Keen, M.D., LL.D. Vol. VII. Philadelphia and London: W. B. Saunders Company, 1921.

EPIDEMIC RESPIRATORY DISEASE; THE PNEUMONIAS AND OTHER INFECTIONS OF THE RESPIRATORY TRACT WHICH ACCOMPANY INFLUENZA AND MEASLES. By E. L. Opie, M.D. Francis G. Blake, M.D., James C. Small, M.D., Thomas M. Rivers, M.D. St. Louis: C.V. Mosby Co., 1921.

THE SEX-COMPLEX; A STUDY OF THE RELATIONSHIPS OF THE INTERNAL SECRETIONS TO THE FEMALE CHARACTERISTICS AND FUNCTIONS IN HEALTH AND DISEASE. By W. Blair Bell, B.S., M.D.(Lond.) 2d ed. New York: William Wood & Company, 1921.

DOEDERLEIN-KROENIG OPERATIVE GYNAEKOLOGIE. 4th ed. Leipzig: Georg Thieme, 1921.

TRANSACTIONS OF THE AMERICAN SURGICAL ASSOCIATION. vol. xxxviii, 1920. Edited by John H. Jopson, M.D.

ELEMENTS OF SURGICAL DIAGNOSIS. By Sir Alfred Pearce Gould, K.C.V.O., M.S.(Lond.), F.R.C.S.(Eng.), and Eric Pearce Gould, M.D., M.Ch.(Oxon.), F.R.C.S.(Eng.) 5th ed. revised. New York: Paul B. Hoeber, 1920.

A TEXTBOOK OF GYNÆCOLOGICAL SURGERY. By Comyns Berkeley, M.A., M.C., M.D.(Cantab.), F.R.C.P.(Lond.), M.R.C.S.(Eng.), and Victor Bonney, M.S., M.D., B.Sc.(Lond.), F.R.C.S.(Eng.), M.R.C.P.(Lond.). 2d ed. New York: Paul B. Hoeber, 1920.

GYNECOLOGY. By Brooke M. Anspach, M.D. Philadelphia and London: J. B. Lippincott, 1921.

A Manual of Surgery; for students and practitioners. By Francis I. Stewart, M.D. 5th ed. Philadelphia: P. Blakiston's Sons & Company, 1921.

CORRESPONDENCE

ACUTE GAS-PRODUCING CHOLECYSTITIS

To the Editor: As a somewhat superficial search of recent literature and inquiry among surgeons of my acquaintance fails to reveal a similar case, this report is made.

4573–20. White male, age 44, admitted to Brooklyn Hospital, August 3, 1920. The patient had had typhoid and pneumonia in youth, and most of usual childhood diseases. General health has been good until the past 2 or 3 years, during which he has had indigestion characterized by gas and discomfort after meals, relieved by belching. No vomiting. No severe attacks. Bowels regular. Operation for chronic appendicitis 2 years ago with partial relief.

Three hours before admission patient was taken with sudden severe pain in right upper abdomen, excruciating and continuous, with vomiting and diarrhœa.

On admission to hospital patient was apparently in severe pain. There was board-like rigidity of upper abdomen with general abdominal tenderness most marked in epigastrium; no jaundice. Heart and lungs were negative. Temperature on admission was 98.1°, pulse 62, respiration 36.

Provisional diagnosis: perforated gastric ulcer.

Operation was performed 5 hours after onset. Incision was made through outer border of right rectus. No perforation of viscus or evidence of extravasation was found. A distended hæmorrhagic gall-bladder about 5 inches long was found and removed. Gall-bladder was not opened but felt as if filled with air. No other abnormal condition was found except slight omental adhesion to appendectomy scar. Closure with drainage.

Pathologist's report. Macroscopic examination shows a greatly distended gall-bladder 10 centimeters in length and 6 centimeters in diameter. The wall is dark bluish-red, the veins prominent, the serosa dull. The bladder has a crepitant sensation due to the presence of air. On opening, some dark brownish fluid is found in the bladder, but no stones. The wall is œdematous, the mucosa mottled and covered with grayish-green necrotic exudate.

Microscopic examination of sections show acute gangrenous cholecystitis.

Culture shows streptococcus and bacillus coli.

Post-operative course. Three hours after operation temperature was 101.5°, pulse 115, respiration 35. He ran a moderative febrile course, normal at end of one week. On the twelfth day his temperature began to rise and was of a mild typhoid type for 16 days when it dropped suddenly to normal and remained so. Epigastric pain and tenderness were present during this time. Widal negative. Two blood counts showed respectively 14,400 white blood cells with 86 per cent polynuclears, and 13,800 white blood cells with 85 per cent polymorphonuclears. Moderate seropurulent drainage and some superficial slough in the wound. An X-ray study on September 7 showed probability of a small gastric ulcer, just proximal to the pylorus.

Discharged September 23, 1920, with wound firmly healed but still having some epigastric pain after meals. Referred to stomach clinic.

Follow-up examinations showed steady gain in health and return to normal weight. Working regularly and has no pain but still some sensation of fullness in epigastrium after meals.

Comment. This case was apparently one of the frequent combinations of chronic appendicitis, cholecystitis, and ulcer, with an acute cholecystitis supervening. Effort to isolate the Welch bacillus by culture and animal inoculation failed. The unnatural lightness of the gall-bladder as it was held in the hand after removal was almost uncanny. I ascribed his postoperative fever course to an infection at the gall-bladder site, possibly a late leakage from the duct, though no bile appeared in the drainage.

Brooklyn. ERNEST K. TANNER, M.D., F.A.C.S

TREATING FRACTURES OF PATELLA BY MEANS OF SILVER WIRE

To the Editor: In the March number of SURGERY GYNECOLOGY AND OBSTETRICS, I notice a method described of treating fractures of the patella by means of pins. For many years I have been treating such fractures in much the same manner, using silver wire instead of pins. The ends of the wires are twisted over a piece of gauze until the fragments of bone are in close apposition. The ends of the wires are then bent over upon the gauze, and a splint and bandage applied. When the fragments are firmly united, one end of each wire is cut close to the skin and pulled out the other side.

D. A. ROBINSON.

Bangor, Me.

AMERICAN COLLEGE OF SURGEONS

HOSPITAL STANDARDIZATION

GRADUALLY the hospital standardization campaign of the American College of Surgeons has come to be a practical answer to the question as to how the people of the United States and Canada may protect for themselves the right to be well. The initiative in the work springs from the medical profession. Through definite and regular analyses of the care given to patients in hospitals the profession has brought about a swift reconstruction of its own responsibility, socially and scientifically, to the public; and the public has responded in turn with new interest in hospitals, with increased confidence in the physicians and surgeons engaged in the work, and with additional financial support toward all that these physicians and surgeons desire.

Hospital standardization aims to create conditions in the practice of medicine out of which every patient, however humble, may receive the highest service known to the profession. Through conscientious and fearless study of what happens to patients from month to month, it aims to do away with lax or lazy diagnoses and treatments, with unnecessary surgical operations, and with operations performed by unskilled surgeons. It aims to prevent avoidable mistakes from happening a second time; to create and to protect the right to be well for every man, woman, and child.

In order to give the program a definite and tangible beginning, the College proposed to the hospitals and to the medical profession, in 1917, a minimum standard of service to patients. It then employed visitors, or "inspectors," to present this standard to the hospital and doctors, and to explain what the standard is and what it means. The College did not assume authority to enforce the standard. At all times the College depends upon the sheer merit and soundness of its proposals to win and to hold the co-operation of those concerned in the work.

The minimum standard is not a formula nor a set of rules like recipes in a cookbook. It is, in effect, the statement of a principle. The principle is that those concerned in the care of the sick or injured shall bring their experience under regular review, and utilize their increased intelligence gained in this way for the better care of the sick or injured in the future.

The principle of hospital standardization means, then, that progress is forever a process of change. For example, the intelligent treatment of diphtheria today is quite a different treatment from what it was a generation ago. Right treatment of any illness is not a matter which can be settled once and for all time; rather it is a matter which is subject always to change and betterment. Always as a basis of progress the medical profession seeks to clarify what is obscure in its work, to trace consequences to their causes, to persist with sympathy and clear thought in order to find, if possible, the reason for each failure and then to take such action as seems best suited to prevent each failure from occurring again. When the members of a hospital staff, in dead earnest, work together in this way, they not only guarantee competent service to all patients in their hospital, but they put themselves into strong position to ask for the confidence, good will, and financial support of the public for the hospital. Further, such a program is lasting inspiration to the staff members, for it encourages personal initiative, freedom, and foresight.

If, now, physicians and surgeons are to review in a satisfactory manner their successes and failures in practice, they must have the facts upon which the successes and failures rest. Such facts are usually to be found in the case record of the various patients. It follows, then, that an adequate writing of case records is a fundamental necessity to the progress of the hospital. In fact, a hospital staff which does not with exacting care write its case records cannot review its own work; and if a staff does not review its own work and utilize the increased intelligence to be gained in this way, it cannot ask upon a rational basis for the good will of its patients or of its community.

There are sound reasons for the writing of case records other than their value for purposes of review, but we need not here discuss them. It is enough to say that an adequate case record system is included within the minimum standard as an imperative factor in good hospital service.

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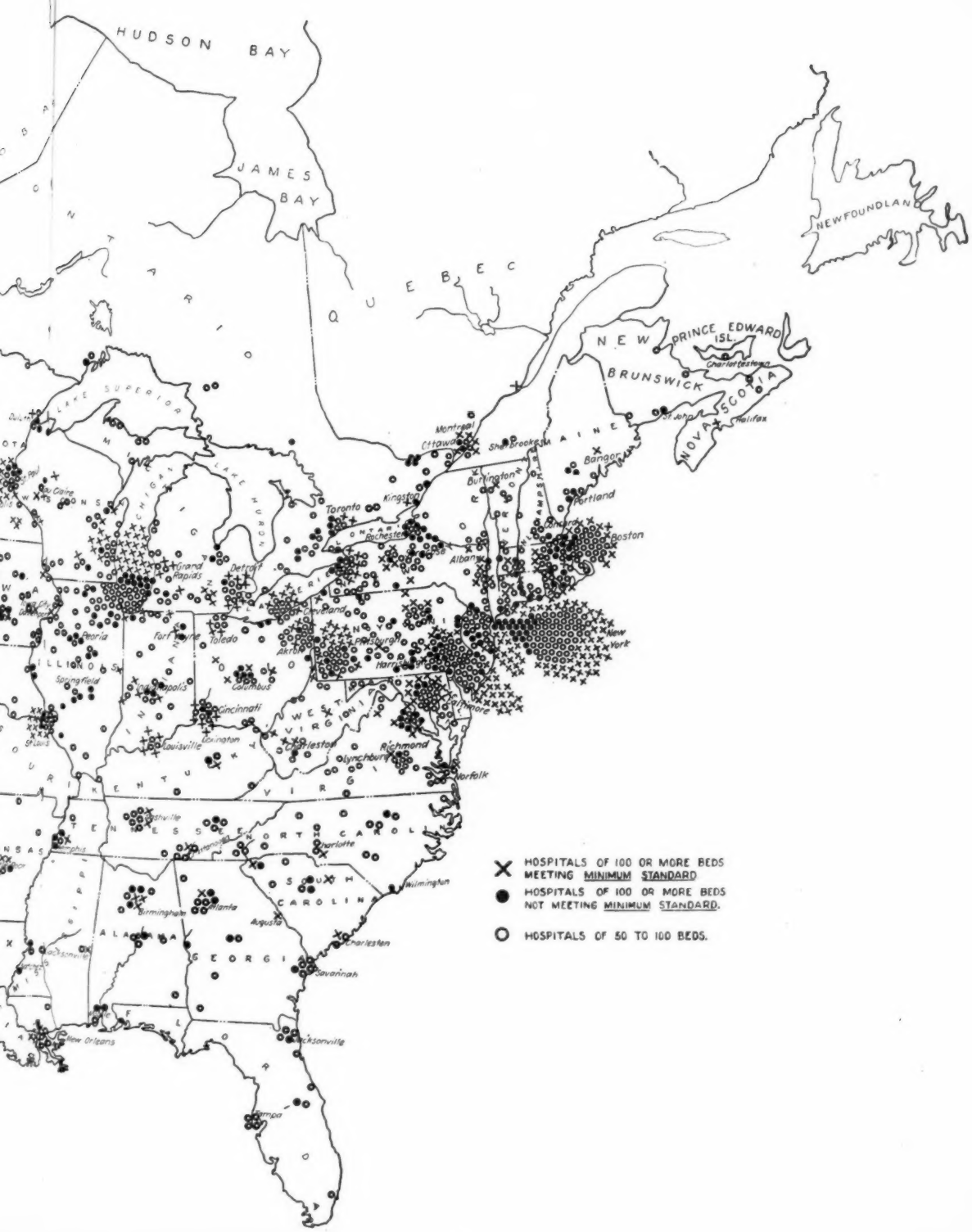
Omaha
Lincoln
Virginia City
Carson City
NEVADA
UTAH
COLORADO
Denver
Pueblo
Topeka
Kansas City
KANSAS
ILLINOIS
Springfield
San Francisco
Los Angeles
San Diego
ARIZONA
Phoenix
Tucson
Santa Fe
Albuquerque
NEW MEXICO
OKLAHOMA
Oklahoma City
ARKANSAS
Little Rock
Dallas
San Antonio
Houston


HUDSON BAY
JAMES BAY
QUEBEC
NEWFOUNDLAND
PRINCE EDWARD ISL.
NEW BRUNSWICK
NOVA SCOTIA
LAKE SUPERIOR
LAKE HURON
Montreal
Ottawa
Sherbrooke
Bangor
Portland
Boston
Toronto
Kingston
Rochester
Albany
Detroit
Grand Rapids
Buffalo
Cleveland
Akron
Pittsburgh
Harrisburg
Philadelphia
New York
Fort Wayne
Toledo
Peoria
Springfield
Columbus
Cincinnati
Louisville
Lexington
Charleston
Richmond
Lynchburg
Norfolk
Memphis
Charlotte
Wilmington
Birmingham
Atlanta
Augusta
Charleston
Savannah
New Orleans
Jacksonville
Tampa
HOSPITALS OF 100 OR MORE BEDS MEETING MINIMUM STANDARD
HOSPITALS OF 100 OR MORE BEDS NOT MEETING MINIMUM STANDARD.
HOSPITALS OF 50 TO 100 BEDS.

ANALYSIS OF HOSPITAL SERVICE

for month ending.....

DISCHARGED

Cured	
Improved	
Relieved	
Unimproved	
To return for secondary operation	
Admitted for diagnosis only	
Deaths within 48 hours	
Deaths institutional (after 48 hours)	
Released	
Labor	
Newborn	
Total discharged	

DIAGNOSES

Provisional and final agree	
Provisional and final disagree	
Discharged with additional diagnosis	
Discharged with no diagnosis made	
Labor	
Newborn	
Total discharged	

INFECTIONS

Institutional		On Admission	
Medical		Medical	
Surgical		Surgical	
Obstetrical		Obstetrical	
Total infections			

CONSULTATIONS

Asked and obtained	
Asked, not obtained	
Indicated, not asked	

DEATHS

Medical	
Surgical	
Obstetrical	
Newborn	
Stillborn	
Total deaths	

AUTOPSIES

Medical	
Surgical	
Obstetrical	
Newborn	
Stillborn	
Total autopsies	

CAUSES OF DEATHS

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Total deaths

UNIMPROVED

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Total unimproved

Again, adequate laboratory service is included in the minimum standard. This requirement needs no explanation. It is today unthinkable that a hospital through its staff should attempt to study and treat illness or injuries without the facilities of a clinical laboratory.

Again, as fundamental to good hospital service it is assumed that men privileged to practice in each hospital are scientifically trained and high-minded. The evil of the division of fees became some years ago so prevalent that the College included a restriction against this practice in the minimum standard.

To summarize, the minimum standard is a statement of a practicable, workable, and constructive plan for hospital betterment. It is a standard that safeguards the care of every patient admitted to the hospital by insistence upon competence on the part of the doctor, upon thorough study and diagnosis in writing for each case, upon efficient laboratory work, and upon a checking up, at least once each month, of the clinical service rendered in the hospital. It fixes responsibility throughout the hospital. It calls for the "production sheets" of the hospital, but does not cause in any way violation of the confidential relationship between the doctor and his patient. It encourages and even compels research. It costs effort rather than money. It defines the minimum service to the patient, which beyond all debate, is essential.

The plan of hospital standardization, as has already been stated, is the working out of a principle and not the application of a set of rules. It is a plan by which physicians and surgeons are able to pledge right service to patients, not upon sentimental ground but upon ground that is altogether defensible and creditable.

THE ANALYSIS OF SERVICE

During these days much thought is being given to find the most effective means to review the clinical work of the hospital. The data as indicated on page 472 are found by a number of hospitals to be of stimulating value when presented to the staffs.* Copies of these data are placed in the hands of each member of the staff; point by point the data are reviewed and the responsibility for the character of the data is shared by each staff member.

In order to compile the data called for on the sheet, it is suggested that a daily review be made of the records of patients discharged. This review will include information under each of the headings of the sheet. When a daily record is kept in this fashion, the summary for the month is merely a matter of arithmetic.

From time to time exhibits are made showing these data comparatively through a series of months. In addition to these data some definite report of the laboratory service of the hospital is helpful. This report should show the extent to which the laboratory is used; and in this connection questions as to the adequacy and competence of the laboratory service should be raised by the staff. The staff should especially recognize good work on the part of the pathologist. All gross material removed at operations should go to the pathologist for report; and the case record of each death in the hospital together with the autopsy record, when available, should be presented as a routine at the next succeeding staff meeting.

THE SURVEY OF 1920

During the last three years the College has each year made surveys of the 697 general hospitals of 100 or more beds in the United States and Canada, measuring the extent to which these hospitals fulfill the minimum standard. The list of approved hospitals contains the names of 407 institutions.

The advance which hospitals have made during these years is indicated by the following figures: Two years ago 89 out of these 697 hospitals fulfilled the minimum standard; one year ago 198 out of the 697 met the standard; at the present time 407 of the group meet the standard.

During the past year about 300 of the 965 general hospitals having from 50 to 100 beds were personally inspected by staff members of the College. No report of the findings among these hospitals is made at this time, as this work is still incomplete.

The three surveys made by the College were accomplished by means of personal visits to the hospitals by staff members of the College. These men, all graduates in medicine, went to the hospitals not as unwelcome visitors but rather as engineers, discovering first what the shortcomings of the institution were in relation to the minimum standard and then indicating how such shortcomings might best be overcome. The council meetings held at the various hospitals by these inspectors proved to be an important element in the success of the work.

THE MINIMUM STANDARD

1. That physicians and surgeons privileged to practice in the hospital be organized as a definite group or staff. Such organization has nothing to do with the question a

*Credit for aid in preparation of this form is due Superintendent Frank E. Chapman, Mt. Sinai Hospital, Cleveland.

File No. .....

AMERICAN COLLEGE OF SURGEONS

CHICAGO

Date.....

Visitor.....

Hospital..... Capacity..... Internes.....

Address..... Type..... Grad. nurses.....

Superintendent..... Affiliation..... Pupil nurses.....

I. STAFF ORGANIZATION

1. Does staff meet at regular intervals?.....
2. If so, how often?.....
3. Does staff consider character of work relative to right care of patients?.....
4. Is the division of fees officially prohibited?.....

II. CASE RECORDS

	FREE	PAY	PRIVATE
Personal History			
Physical Examination			
Working Diagnosis			
Laboratory Findings			
Treatment or Operation			
Progress Notes			
Final Diagnosis			
Condition on Discharge			

Notes.....

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III. CLINICAL LABORATORIES

	IN HOSPITAL	OUT OF HOSPITAL
Chemical		
Bacteriological		
Serological		
Histological		
Radiographic		
Fluoroscopic		

Head Lab. Technician: Trained..Full-Time..Part-Time..

X-Ray Lab. Technician: Trained..Full-Time..Part-Time..

Records kept in lab: Pathological.....X-Ray.....

Notes.....

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(Reverse side of card)

IV. AUTOPSIES

1. No. of deaths in last year..... No. of autopsies.....
2. Does pathologist meet with staff to review clinical history in relation to autopsy findings?.....

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Notes.....

V. GENERAL NOTES

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VI. PERSONS INTERVIEWED AND THEIR POSITION

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to whether the hospital is "open" or "closed," nor need it affect the various existing types of staff organization. The word *staff* is here defined as the group of doctors who practice in the hospital inclusive of all groups such as the "regular staff," the "visiting staff," and the "associate staff."

2. That membership upon the staff be restricted to physicians and surgeons who are (a) competent in their respective fields and (b) worthy in character and in matters of professional ethics; that in this latter connection the practice of the division of fees, under any guise whatever, be prohibited.

3. That the staff initiate and, with the approval of the governing board of the hospital, adopt rules, regulations, and policies governing the professional work of the hospital; that these rules, regulations, and policies specifically provide:

a. That staff meetings be held at least once each month. (In large hospitals the departments may choose to meet separately.)

b. That the staff review and analyze at regular intervals the clinical experience of the staff in the various departments of the hospital, such as medicine, surgery, and obstetrics; the clinical records of patients, free and pay, to be the basis for such review and analyses.

4. That accurate and complete case records be written for all patients and filed in an accessible manner in the hospital, a complete case record being one, except in an emergency, which includes the personal history; the physical examination, with clinical, pathological, and X-ray findings when indicated; the working diagnosis; the treatment, medical and surgical; the medical progress; the condition on discharge with final diagnosis; and, in case of death, the autopsy findings when available.

5. That clinical laboratory facilities be available for the study, diagnoses, and treatment of patients, these facilities to include at least chemical, bacteriological serological, histological, radiographic, and fluoroscopic service in charge of trained technicians.

THE DATA COLLECTED

The work of the hospital visitors of the College is to collect exact information as to the extent to which each hospital visited fulfills the minimum standard. The visitor's card as shown on page 474 indicates the manner in which the data are recorded. On the face of the card the visitor reports concerning staff meetings, case records, and laboratory service; on the reverse side of the card, concerning number of deaths, autopsies, and the extent to which the clinical histories in relation to autopsy findings are reported to the staff. General notes and the names and positions of persons interviewed by the visitor are also recorded.

STATE CLINICAL MEETINGS

MEETINGS of state sections of the Clinical Congress of the American College of Surgeons were held during March for the state of Nebraska at Omaha, March 3 and 4; for Kansas at Wichita, March 7 and 8; for Missouri at St. Louis, March 10 and 11; for Tennessee at Nashville, March 21 and 22, for Kentucky at Louisville, March 25 and 26. At each meeting there were clinical, scientific, and public sessions and a hospital conference on standardization. The programs follow:

NEBRASKA

THURSDAY, MARCH 3

Clinics

At the St. Joseph, Methodist, Clarkson, Immanuel, Swedish Mission, Wise Memorial, and University Hospitals, 8 a.m. to 12 m.

Hospital Conference, 10 a.m.

John E. Summers, M.D., Chairman, Nebraska State Section, Presiding.
The Hospital Program of the American College of Surgeons, and the Meaning of the Minimum Standard—Judge Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
The Program of the American College of Surgeons as Applied to Catholic Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.
The Work of the Hospital Surveyor—James L. Smith, M.D., Hospital Survey Department, American College of Surgeons.
Experience with the Standardization Program of the American College of Surgeons, from the Hospital Superintendent's Standpoint—Irving S. Cutter, M.D., Dean of the University of Nebraska College of Medicine.
Discussion—Opened by H. von W. Schulte, M.D., Dean of the Creighton College of Medicine.
Experience with the Standardization Program of the American College of Surgeons, from the Surgeon's Standpoint—A. R. Mitchell, M. D., Lincoln.
Discussions—Opened by Delmar L. Davis, M.D., Omaha.

Scientific Session, 2 p.m.

Symposium on Cancer

Pathology and Etiology—Burton T. Simpson, M.D., Buffalo, N. Y.
Discussion—Opened by C. C. Hilton, M.D., Lincoln.
Tissue Diagnosis—Wm. C. MacCarty, M.D., Rochester, Minn.
Discussion—Opened by H. E. Eggers, M.D., Omaha.
Radiology—Daniel T. Quigley, M.D., Omaha.
Discussion—Opened by A. I. MacKinnon, M.D., Lincoln.
Cancer of the Breast—B. B. Davis, M.D., Omaha.
Discussion—Harry M. Hepperlen, M.D., Beatrice, Nebr., and William C. MacCarty, M.D., Rochester, Minn.
Cancer of the Uterus—Palmer Findley, M.D., Omaha.
Radiotherapy vs. Radical Operation for Cancer of the Uterus—George Gellhorn, M.D., St. Louis, Mo.

Public Meeting, 8 p.m.

J. E. Summers, M.D., Chairman, Nebraska State Section, Presiding.
Invocation—Rev. Frank Smith, Omaha.
Address of Welcome—Mayor E. Smith, Omaha.
Program of the American College of Surgeons—Harold M. Stephens, Director of Hospital Activities American College of Surgeons.
What the Public Should Know About Disease—A. F. Jonas, M.D., Omaha.
Campaign on Cancer—Francis Carter Wood, M.D., New York.
Standardization of Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.

FRIDAY, MARCH 4

Clinics

At the Presbyterian, St. Catherine's, Methodist, Clarkson, Immanuel, Swedish Mission, Wise Memorial, University, Radium, and St. Joseph's Hospitals, 8 a. m. to 12 p.m.

Scientific Session, 2 p.m.

Symposium on Gastric and Duodenal Ulcer

Etiology (Symptoms and Medical Treatment)—E. L. Bridges, M.D., Omaha.
Discussion—Opened by A. R. Mitchell, M.D., Lincoln.
X-Ray in Diagnosis—James T. Case, M.D., Battle Creek, Mich.
Discussion—Opened by Stuart A. Campbell, M.D., Norfolk.
Indications for Surgical Treatment—A. F. Jonas, M.D., Omaha.
Discussion—Opened by P. H. Salter, M.D., Norfolk.
Operative Treatment—J. E. Summers, M.D., Omaha.
Discussion—Opened by A. C. Stokes, M.D., Omaha.
Postoperative Treatment—J. Stanley Welch, M.D., Lincoln.
Discussion—Opened by George Pratt, Omaha, Nebr.
Symptoms and Treatment of Gastrojejunal Ulcer.—Delmer L. Davis, M.D.
Discussion—Opened by William C. MacCarty, M.D., Rochester, Minn.
Etiological Factors in Gastrojejunal Ulcer—C. A. Roeder, M.D., Omaha.

Women's Public Meeting, 4 p.m.

Popular Talk on Cancer—Burton T. Simpson, M.D., Buffalo, N.Y.
The Cancer Problem (illustrated by slides)—Palmer Findley, M.D. Omaha.

KANSAS

MONDAY, MARCH 7

Clinics

At St. Francis and Wesley Hospitals, 9 a.m. to 12 m.

Hospital Conference, 2:30 p.m.

Charles E. Bowers, M.D., Chairman, Kansas State Section, Presiding.
The Meaning of the Minimum Standard—Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.

The Work of the Hospital Surveyor—James L. Smith, M.D., Hospital Survey Department, American College of Surgeons.
Experience with the Standardization Program of the American College of Surgeons, from the Surgeon's Standpoint—Charles E. Bowers, M.D., Wichita.
Experience with the Standardization Program of the American College of Surgeons, from the Hospital Superintendent's Standpoint—S. G. Ascher, Superintendent, Wichita Hospital.
Discussion—Opened by Harry W. Horn, M.D., Wichita.

Public Meeting, 8 p.m.

C. E. Bowers, M.D., Chairman, Kansas State Section, Presiding.
Address of Welcome—Henry J. Allen, Governor of Kansas.
The Program of the American College of Surgeons—Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
What the Public Can Do to Increase the Good Results in Surgery—Allen B. Kanavel, M.D., Chicago, Professor of Surgery, Northwestern University Medical School, Chicago.
Why the Church Believes in Medical Education of the Laity. Rev. W. M. Farrell. Rev. Otis Grey, and Rev. H. C. Herring, Jr.

TUESDAY, MARCH 8

Clinics

At St. Francis and Wichita Hospitals, 9 a.m. to 12 m.

Scientific Session, 2:30 p.m.

Clinical Experiences and Investigative Studies in Tic Doulloureux and Allied Neuralgias. Allen B. Kanavel, M.D., Professor of Surgery, Northwestern University. Medical School. Chicago.
Some Postoperative Complications—Harry W. Horn, M.D., Wichita.
The Interposition Operation for Descensus Uteri and Cystocele—D. W. Basham, M.D., Wichita.

MISSOURI

THURSDAY, MARCH 10

Clinics

At the Barnes, Jewish, St. Anthony's, St. John's, St. Louis City, and St. Luke's Hospitals, and the Missouri Baptist Sanitarium, 9 a.m. to 12 m.

Hospital Conference, 2 p.m.

Harvey G. Mudd, M.D., Chairman, Missouri State Section, Presiding.
The Hospital Program of the American College of Surgeons and the Meaning of the Minimum Standard—Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
The Program of the American College of Surgeons as Applied to Catholic Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.
The Work of the Hospital Surveyor—James L. Smith, M.D., Hospital Survey Department, American College of Surgeons.
Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint—Major G. Seelig, M.D., St. Louis.
Experience with the Standardization Program of the American College of Surgeons from the Hospital Superintendent's Standpoint—L. H. Burlingham, Superintendent, Barnes and St. Louis Children's Hospitals.
Discussion—Opened by Evarts A. Graham, M.D., St. Louis.

Public Meeting 8:30 p.m.

H. G. Mudd, M.D., Chairman, Missouri State Section, Presiding.
Address of Welcome—Honorable Frederick W. Lehmann.
Surgical Researches in Peace and War—George W. Crile, M.D., Cleveland, Ohio.
Program of the American College of Surgeons.—Judge Harold M. Stephens, Director of American College of Surgeons.
Standardization of Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.

FRIDAY, MARCH 11

Clinics

At the Barnard Skin and Cancer, Barnes, Jewish, St. John's, St. Louis City, Mullanphy, St. Luke's, and St. Mary's Hospitals, and the Missouri Baptist Sanitarium, 9 a.m. to 12 m.

Scientific Session, 2:30 p.m.

Laryngectomy—N. B. Carson, M.D.
The Rôle of the Liver in Abdominal Operations—George W. Crile, M.D., Cleveland, Ohio.
Some Surgical Odds and Ends—J. F. Binnie, M.D., Kansas City.

TENNESSEE

MONDAY, MARCH 21

Clinics

At the St. Thomas, Protestant, and Woman's Hospitals and Dr. Barr's Infirmary, 8:30 a.m. to 12:30 p.m.

Hospital Conference, 2:30 p.m.

W. A. Bryan, M.D., Chairman, Tennessee State Section, Presiding.
The Meaning of the Minimum Standard—Judge Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
The Soul of Standardization—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.
The Work of the Hospital Surveyor—James L. Smith, M.D., Hospital Survey Department, American College of Surgeons.
Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint—W. D. Haggard, M.D., Nashville.
Experience with the Standardization Program of the American College of Surgeons from the Hospital Superintendent's Standpoint—Mr. Joseph Purvis, Superintendent, Methodist Hospital, Memphis.
Discussion—Opened by E. Dunbar Newell, M.D., Chattanooga.

Public Meeting, 8 p.m.

Hon. Alfred A. Taylor, Governor of Tennessee, Presiding.
The American College of Surgeons—Judge Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
The Early Recognition of Cancer—V. P. Blair, M.D., F.A.C.S., Associate Professor of Surgery, Washington University, St. Louis.
The Relation of the Surgeon to the Public—William R. Cubbins M.D., Associate Professor of Surgery, Northwestern University, Chicago.
The Standardization of Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.
Community Health as a National Asset—Professor G. A. Dyer.

TUESDAY, MARCH 22

Clinics

At the St. Thomas, Protestant, and Woman's Hospital, and Dr. Barr's Infirmary, 8:30 a.m. to 12:30 p.m.

Scientific Session, 2:30 p.m.

W. A. Bryan, M.D., Chairman, Tennessee State Section, Presiding.
The Operative Treatment of Fractures—Battle Malone, M.D., Memphis.
The Present Status of the Operative Treatment of Fractures—William R. Cubbins, M.D., Chicago.
Delayed Transplantation of Pedicle Flaps—V. P. Blair, M.D., St. Louis.

KENTUCKY

FRIDAY, MARCH 25

Clinics

At the City, Children's Free, Deaconess, St. Anthony, and Sts. Mary & Elizabeth Hospital, and The Norton Memorial, and St. Joseph's Infirmaries, 8:30 a.m. to 12:30 p.m.

Hospital Conference, 2:30 p.m.

Lewis S. McMurty M.D., Chairman, Kentucky State Section, Presiding.
The Hospital Program of the American College of Surgeons and the Meaning of the Minimum Standard—Harold M. Stephens, Director of Hospital Activities, American College of Surgeons.
The Program of the American College of Surgeons as Applied to Catholic Hospitals—Rev. C. B. Moulinier, S.J., President of the Catholic Hospital Association.
The Work of the Hospital Surveyor—James L. Smith, M.D., Hospital Survey Department, American College of Surgeons.
Experience with the Standardization Program of the American College of Surgeons from the Surgeon's Standpoint—Irvin Abell, M.D., Louisville.
Experience with the Standardization Program of the American College of Surgeons from the Hospital Superintendent's Standpoint—Henry E. Tuley, M.D., Louisville.
Discussion—Opened by A. T. McCormack, M.D., Louisville.

Public Meeting, 8 p.m.

Hon. Edwin P. Morrow, Governor of Kentucky, Presiding.
The American College of Surgeons—Judge Harold M. Stephens, Director of Hospital Activities, American College of Surgeons, Chicago.
Surgical Researches in Peace and War—George W. Crile, M.D., Professor of Surgery, Western Reserve University School of Medicine, Cleveland.
The Hospital and the Community—Carl B. Davis, M.D., Assistant Professor of Surgery, Rush Medical College, Chicago.
The Standardization of Hospitals—Rev. C. B. Moulinier, S.J., President of Catholic Hospital Association, Milwaukee.
How You Can Make Louisville a Health Center—A. T McCormack, M.D., State Health Officer of Kentucky, Louisville.

SATURDAY, MARCH 26

Clinics

At the Children's Free, City, Deaconess, St. Anthony, and Sts. Mary and Elizabeth Hospitals, and the Norton Memorial, and St. Joseph's Infirmaries, 8:30 a.m. to 12:30 p.m.

Scientific Session, 2:30 p.m.

L. S. McMurtry, M.D. Chairman, Kentucky State Section, Presiding.
The Rôle of the Liver in Abdominal Operations—George W. Crile, M.D., Cleveland.
Surgery of the Large Bowel—Carl B. Davis, M.D., Chicago.
Preparatory Treatment of Prostatectomy—J. H. Blackburn, M.D., Bowling Green.

MEETINGS TO BE HELD

Indiana—Indianapolis, May 2 and 3.
Joint Meeting, Maryland and District of Columbia—Baltimore and Washington, May 10 and 11.
Massachusetts—Springfield, May 13 and 14.
Connecticut—New Haven, May 23 and 24.